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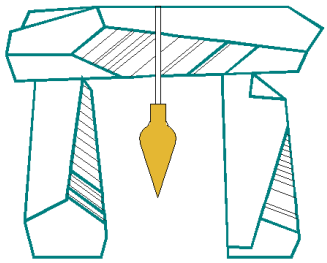

& Associates, Inc.

Revised Engineering Report

for a

Multi-Unit Residential Development
91 Beatrice Circle
Belmont, Massachusetts

Prepared by:

DeCelle-Burke-Sala & Associates, Inc.
1266 Furnace Brook Parkway
Suite 401
Quincy, MA 02169

Prepared for:

91 Beatrice Circle LLC
c/o Regnante Sterio
401 Edgewater Pl., #603
Wakefield, MA 01880

April 22, 2021

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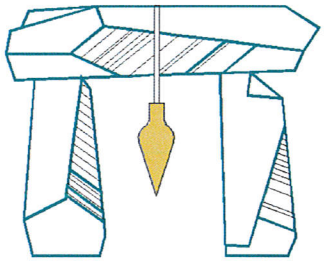

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April 22, 2021

Table of Contents

SECTION 1 -

Revised Stormwater Management Narrative & Flow Summaries

DBS has reviewed and revised the stormwater management report previously submitted to the Town of Belmont and has prepared this revised Engineering Report in response to the Town of Belmont's Peer Review Engineer, Weston & Sampson Engineers. Some of the revisions were fundamental to stormwater management design including watershed delineation and soil coverage determination while others were more ancillary and preferential. The design is basically the same as previously proposed.

The revised stormwater management system consists of a surface collection system that includes two deep sump catch basins, a CDS water quality structure manufactured by Contech and a single underground Cultec recharge system with 51 chambers and an outlet control structure that releases stormwater flow to the Frontage Road by a direct drainage pipe connection. The system, as previously designed provides local flood control, groundwater recharge compliance and stormwater quality treatment. The system as proposed meets MassDEP Stormwater Management Standards and reduces flow off the property in three separate watersheds for the 2, 10, 25, and 100-year storm events.

DBS revised the existing conditions watershed map to show three separate watersheds. Sub watershed X-1 flows to the south to residential abutters with frontage on Beatrice Circle. Sub-watershed X-2 flows to the east to a residential abutter. Sub-watershed X-3 flows to Frontage Road as does sub-watershed X-4. X-4 was added to the revised analysis to include the access drive into the lot which crosses the Beatrice Circle roadway layout. Sub-watershed X-4 represents off-locus property that is subject to construction by access drive revisions. The hydrographs generated for X-3 and X-4 were added together using reach 1R to represent stormwater flow to Frontage Road and for future comparison with the proposed conditions.

The four sub-watersheds were modeled using HSG A soils having land cover of woods, grass, roof and pavement with minimum times of concentration of six minutes each. Hydrographs were generated for the 2, 10, 25, and 100-Year storm events using the National Oceanic and Atmospheric Administration (NOAA) Atlas 14 Volume 10 rainfall values. The rainfall values for the 2, 10, 25 and 100-year events are 3.27", 5.16", 6.34" and 8.15", respectively using a 24-hour Type III distribution curve.

The proposed conditions watershed map was delineated using the existing watershed map as a base for model comparison points. The proposed sub-watershed flowing to the south to the residential abutters corresponding to existing sub-watershed X-1 was reduced to zero. There is no proposed stormwater flow generated to the south. Proposed sub-watershed A-2 flowing to the east to the residential abutter was also significantly reduced. This reduction decreased the stormwater flow and volume to this abutter. Proposed sub-watersheds A-3 and A-4 representing the uncontrolled flow to Frontage Road were also was significantly reduced in area and with the

inclusion of the detained outflow from the underground detention basin reduces the peak flow to Frontage Road.

Several internal sub-watersheds for the roof and parking lot stormwater runoff were delineated to design the underground infiltration basin. The basin consisting of 51 Cultec 330 XLHD chambers has direct connections from the collected roof runoff inlets and one connection from the collected parking lot runoff. The parking lot runoff is conveyed to two deep sump catch basins fitted with a SNOUT®, a proprietary water quality treatment outlet control hood. The catch basin flow is conveyed to a CDS water quality structure manufactured by Contech. This structure is designed to remove 50% of Total Suspended Solids (TSS) prior to the stormwater being conveyed into the Cultec chambers. We used a Rawl's Rate of 2.41 inches per hour for an exfiltration rate based on the HSG-A soils. An outlet control structure consisting of 3" cored orifice into Cultec Chamber end cap constructed within a manhole releases a controlled overflow to a Frontage Road drainage pipe. A "doghouse" manhole shall be constructed at this connection for ongoing inspections and maintenance.

Massachusetts Stormwater Management Standards Compliance

The results of the HydroCAD calculations are tabulated below for comparison with the existing and proposed condition values. The project complies with the stormwater management standards outlined below:

Standard 1	-	No New stormwater conveyances discharge untreated stormwater directly to the waters of the Commonwealth;
Standard 2	-	Post Development peak discharge rates are less than pre-development;
Standard 3	-	The recharge volume required for this project is exceeded.
Standard 4-		The project meets the water quality standards.
Standard 5	-	N/A
Standard 6	-	N/A
Standard 7-		The project does not qualify as a redevelopment project.
Standard 8-		A revised erosion control plan has been prepared for the short term prevention of erosion, sedimentation and the off-site transport of suspended solids.
Standard 9	-	A Revised Long Term Operation and Maintenance Plan is attached.
Standard 10-		Per Standard No. 10 of the MassDEP Stormwater Management Standards, there shall be no illicit discharges to the stormwater management system. The Property Manager is responsible for implementing the Operation and Maintenance Plan and overseeing activities at the facility to prevent illicit discharges to the drainage system from occurring. It is strictly prohibited to discharge any products or substances onto the ground surface or into any drainage structures, such as catch basin inlets, manholes, or drainage outlets that would be a detriment to the environment.

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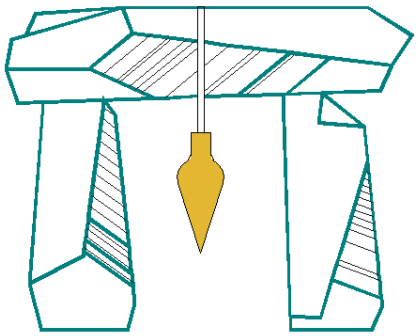

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April 19, 2021

Off-Site Peak Stormwater Flow Comparison Chart
for Pre- and Post-Construction
91 Beatrice Circle
Belmont, MA

Flow to Frontage Road

2 Year Storm (3.27")			
Existing Conditions		Proposed Conditions	
Area Description	Flow (CFS)	Area Description	Flow (CFS)
Flow off-site	0.10	Flow off-site	0.10

10 Year Storm (5.16")			
Existing Conditions		Proposed Conditions	
Area Description	Flow (CFS)	Area Description	Flow (CFS)
Flow off-site	0.46	Flow off-site	0.37

25 Year Storm (6.34")			
Existing Conditions		Proposed Conditions	
Area Description	Flow (CFS)	Area Description	Flow (CFS)
Flow off-site	0.74	Flow off-site	0.57

100 Year Storm (8.15")			
Existing Conditions		Proposed Conditions	
Area Description	Flow (CFS)	Area Description	Flow (CFS)
Flow off-site	1.23	Flow off-site	1.15

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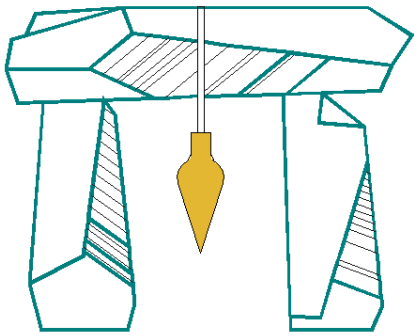

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April 19, 2021

Off-Site Peak Stormwater Flow Comparison Chart
for Pre- and Post-Construction
91 Beatrice Circle
Belmont, MA

Flow to East

2 Year Storm (3.27")			
Existing Conditions		Proposed Conditions	
Area Description	Flow (CFS)	Area Description	Flow (CFS)
Flow off-site	0.12	Flow off-site	0.0

10 Year Storm (5.16")			
Existing Conditions		Proposed Conditions	
Area Description	Flow (CFS)	Area Description	Flow (CFS)
Flow off-site	0.45	Flow off-site	0.0

25 Year Storm (6.34")			
Existing Conditions		Proposed Conditions	
Area Description	Flow (CFS)	Area Description	Flow (CFS)
Flow off-site	0.70	Flow off-site	0.03

100 Year Storm (8.15")			
Existing Conditions		Proposed Conditions	
Area Description	Flow (CFS)	Area Description	Flow (CFS)
Flow off-site	1.12	Flow off-site	0.11

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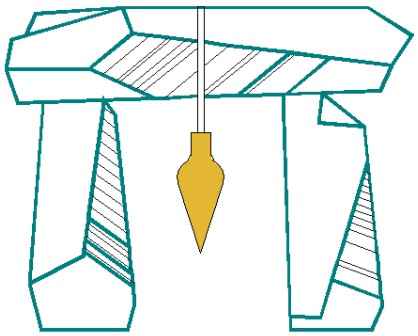

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April 19, 2021

Off-Site Peak Stormwater Flow Comparison Chart
for Pre- and Post-Construction
91 Beatrice Circle
Belmont, MA

Flow to South

2 Year Storm (3.27")			
Existing Conditions		Proposed Conditions	
Area Description	Flow (CFS)	Area Description	Flow (CFS)
Flow off-site	0.01	Flow off-site	0.0

10 Year Storm (5.16")			
Existing Conditions		Proposed Conditions	
Area Description	Flow (CFS)	Area Description	Flow (CFS)
Flow off-site	0.13	Flow off-site	0.0

25 Year Storm (6.34")			
Existing Conditions		Proposed Conditions	
Area Description	Flow (CFS)	Area Description	Flow (CFS)
Flow off-site	0.27	Flow off-site	0.0

100 Year Storm (8.15")			
Existing Conditions		Proposed Conditions	
Area Description	Flow (CFS)	Area Description	Flow (CFS)
Flow off-site	0.50	Flow off-site	0.0

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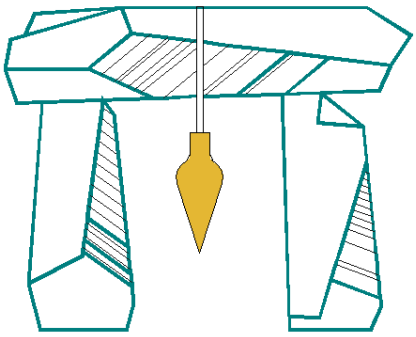

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April 19, 2021

Off-Site Stormwater Volume Comparison Chart for Pre- and Post-Construction
91 Beatrice Circle
Belmont, MA

2 Year Storm (3.27")			
Existing Conditions		Proposed Conditions	
Area Description	Flow (CF)	Area Description	Flow (CF)
Flow off-site	1,131	Flow off-site	459

10 Year Storm (5.16")			
Existing Conditions		Proposed Conditions	
Area Description	Flow (CF)	Area Description	Flow (CF)
Flow off-site	4,371	Flow off-site	2,101

25 Year Storm (6.34")			
Existing Conditions		Proposed Conditions	
Area Description	Flow (CF)	Area Description	Flow (CF)
Flow off-site	5,592	Flow off-site	3,688

100 Year Storm (8.15")			
Existing Conditions		Proposed Conditions	
Area Description	Flow (CF)	Area Description	Flow (CF)
Flow off-site	9,002	Flow off-site	6,578

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SECTION 1 - STORMWATER MANAGEMENT DATA

Checklist for Stormwater Report
Standard 3 Compliance
Standard 4 Compliance (TSS Removal)
Pipe Sizing (Rational Method)
Groundwater Mounding
HydroCAD Calculations
Existing Conditions
2-Year
10-Year
25-Year
100-Year
Proposed Conditions
2-Year
10-Year
25-Year
100-Year
Watershed Maps

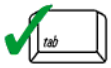
Checklist for Stormwater Report

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

A. Introduction

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the Massachusetts Stormwater Handbook. The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.[1] This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8[2]
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

[1] The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

[2] For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

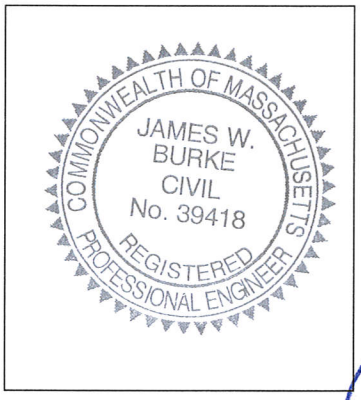
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature



4/22/21

Signature and Date

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

- ☒ No disturbance to any Wetland Resource Areas
- ☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- ☐ Reduced Impervious Area (Redevelopment Only)
- ☐ Minimizing disturbance to existing trees and shrubs
- ☐ LID Site Design Credit Requested:
  - ☐ Credit 1
  - ☐ Credit 2
  - ☐ Credit 3
- ☐ Use of "country drainage" versus curb and gutter conveyance and pipe
- ☐ Bioretention Cells (includes Rain Gardens)
- ☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- ☐ Treebox Filter
- ☐ Water Quality Swale
- ☐ Grass Channel
- ☐ Green Roof
- ☐ Other (describe): _____

Standard 1: No New Untreated Discharges

- ☒ No new untreated discharges
- ☐ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- ☐ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.

☒ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

☒ Sizing the infiltration, BMPs is based on the following method: Check the method used.

☐ Static ☒ Simple Dynamic ☐ Dynamic Field[1]

☐ Runoff from all impervious areas at the site discharging to the infiltration BMP.

☒ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.

☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:

- ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
- ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
- ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
- ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

[1] 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

☒ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☐ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

☒ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.

☐ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:

- ☐ is within the Zone II or Interim Wellhead Protection Area
- ☐ is near or to other critical areas
- ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
- ☐ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

☒ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

☒ The BMP is sized (and calculations provided) based on:

- ☒ The ½" or 1" Water Quality Volume or
- ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

☐ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.

☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.

☒ The NPDES Multi-Sector General Permit does ***not*** cover the land use.

☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☐ All exposure has been eliminated.

☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☐ Critical areas and BMPs are identified in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

☐ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

- ☐ Limited Project
- ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- ☐ Bike Path and/or Foot Path
- ☐ Redevelopment Project
- ☐ Redevelopment portion of mix of new and redevelopment.

☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☐ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

☒ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has ***not*** been included in the Stormwater Report but will be submitted ***before*** land disturbance begins.

☒ The project is ***not*** covered by a NPDES Construction General Permit.

☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

☐ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

- ☒ Name of the stormwater management system owners;
- ☒ Party responsible for operation and maintenance;
- ☒ Schedule for implementation of routine and non-routine maintenance tasks;
- ☒ Plan showing the location of all stormwater BMPs maintenance access areas;
- ☒ Description and delineation of public safety features;
- ☒ Estimated operation and maintenance budget; and
- ☒ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

- ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
- ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

☒ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

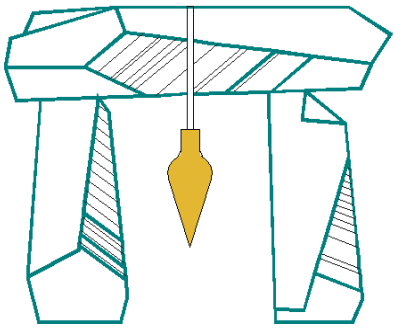
☒ An Illicit Discharge Compliance Statement is attached;

☐ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.

Standard 3 Compliance

Calculation Sheet

DeCelle-Burke-Sala



& Associates, Inc.

Project: Multi-Unit Development
91 Beatrice Circle
Belmont, MA

Client: 91 Beatrice Circle LLC
401 Edgewater Place #603, Wakefield, MA

Date: 4/19/2020

Standard 3/4 Compliance

Step 1.

Find: Recharge Volume Requirement

Given: Rv = (F x impervious area)

A = 19,099 s.f. impervious area F= 1 " for Water Quality

Solve: Rv = 19,099 s.f. x 1 "/12'= 1,591.58 c.f.

Impervious to system= 14,766 s.f.

Adjustment Factor= 1.29

Adjusted Rv= 2,058.62 c.f.

Step 2.

Select a 24-hour rainfall event that generates the Rv during the peak 2 hours. Use only the Site's impervious drainage area and the default NRCS Initial Abstraction of 0.2S and Type III storm. Set storm duration for 24 hours, but use a start time of 11 hours and an end time of 13 hours.

Rainfall Depth Generating Rv 2,058.62 c.f. is 3.44 in.

Step 3.

Bottom area of infiltration system = length x width

= 17.00 ft x 130.50 ft

= 2,218.50 s.f.

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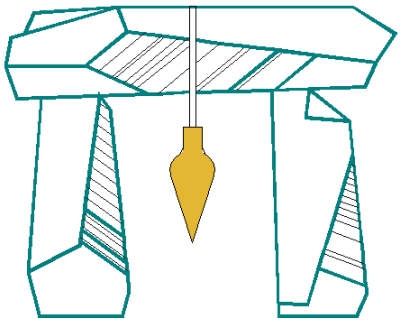
1266 Furnace Brook Pkwy., #401 Quincy, MA 02169
617-405-5100 (o) 617-405-5101 (f)

Calculation Sheet

DeCelle-Burke-Sala



& Associates, Inc.

Project: Multi-Unit Development
91 Beatrice Circle
Belmont, MA

Client: 91 Beatrice Circle LLC
401 Edgewater Place #603, Wakefield, MA

Date: 4/19/2020

Step 4.

Set exfiltration in HydroCAD to exfiltrate through the bottom only.
Exfiltration rate to be the Rawls Rate based on the soil analysis.

Step 5.

Determine if recharge system can handle required recharge volume.

Solve: See Attached HydroCAD

Depth of Infiltration System below outlet= 1.10 ft.

Find: Depth of Rv within Infiltration System

Peak Elevation - Bottom of Field = Corresponding Field Depth

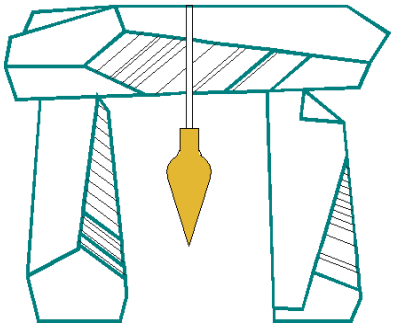
220.03 ft. - 219.00 ft. = 1.03 ft.

CHECKS OK

DeCelle-Burke-Sala Asscociates, Inc.
1266 Furnace Brook Pkwy., #401 Quincy, MA 02169
617-405-5100 (o) 617-405-5101 (f)

Calculation Sheet

DeCelle-Burke-Sala



& Associates, Inc.

Project: Multi-Unit Development
91 Beatrice Circle
Belmont, MA

Client: 91 Beatrice Circle LLC
401 Edgewater Place #603, Wakefield, MA

Date: 4/19/2020

Step 6.

Draw Down Time

Find: T= Rv / (KxBottom Area)

Given: Bottom Area = 2,218.50 s.f. K= 2.41 in/hr

Rv= 2058.62 c.f.

2058.62 c.f./((in/hr/12 in/ft) x 2218.5 s.f.

= 4.6 hrs < 72 hrs **CHECKS OK**

Rv (Required Recharge Volume)

K (Hydraulic Conductivity-use Rawls Rate)

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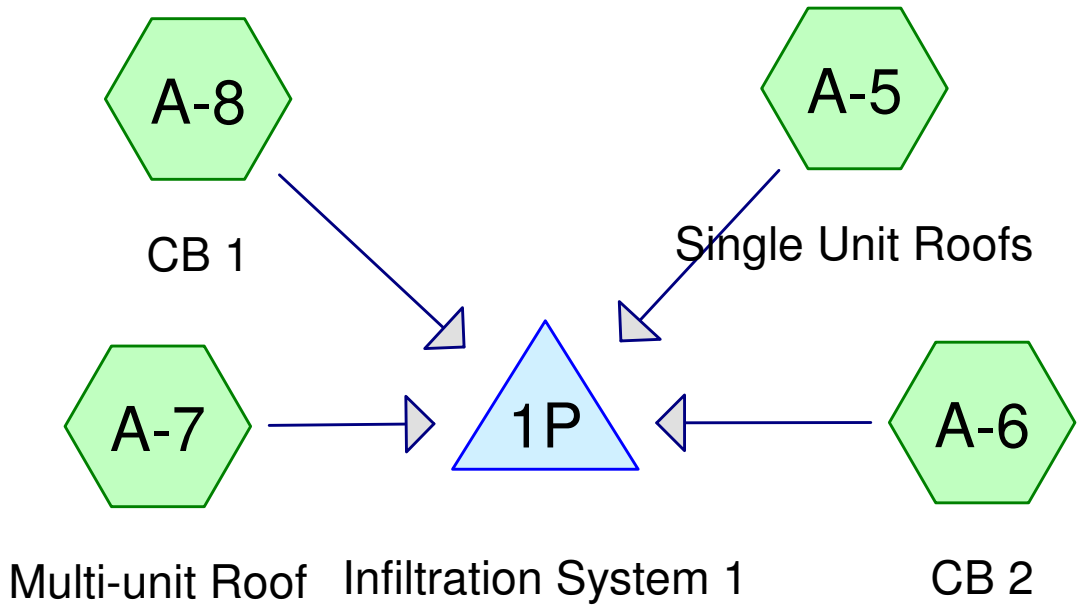


Subcat Reach Pond Link

Routing Diagram for 91 Beatrice STD 3
Prepared by DeCelle-Burke-Sala & Associates, Inc., Printed 4/21/2021

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
565	39	>75% Grass cover, Good, HSG A (A-6, A-8)
7,007	98	Paved parking (A-6, A-8)
7,759	98	Roofs (A-5, A-7)
15,331	**96**	**TOTAL AREA**

Summary for Subcatchment A-5: Single Unit Roofs

Runoff = 0.26 cfs @ 12.08 hrs, Volume= 485 cf, Depth> 1.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 11.00-13.00 hrs, dt= 0.01 hrs
Type III 24-hr Rainfall=3.44"

	Area (sf)	CN	Description
*	3,438	98	Roofs
	3,438		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Minimum Tc**

Summary for Subcatchment A-6: CB 2

Runoff = 0.12 cfs @ 12.08 hrs, Volume= 220 cf, Depth> 1.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 11.00-13.00 hrs, dt= 0.01 hrs
Type III 24-hr Rainfall=3.44"

	Area (sf)	CN	Description
*	1,569	98	Paved parking
	51	39	>75% Grass cover, Good, HSG A
	1,620	96	Weighted Average
	51		3.15% Pervious Area
	1,569		96.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Minimum Tc**

Summary for Subcatchment A-7: Multi-unit Roof

Runoff = 0.33 cfs @ 12.08 hrs, Volume= 610 cf, Depth> 1.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 11.00-13.00 hrs, dt= 0.01 hrs
Type III 24-hr Rainfall=3.44"

	Area (sf)	CN	Description
*	4,321	98	Roofs
	4,321		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Minimum Tc**

Summary for Subcatchment A-8: CB 1

Runoff = 0.41 cfs @ 12.09 hrs, Volume= 747 cf, Depth> 1.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 11.00-13.00 hrs, dt= 0.01 hrs
Type III 24-hr Rainfall=3.44"

	Area (sf)	CN	Description
*	5,438	98	Paved parking
	514	39	>75% Grass cover, Good, HSG A
	5,952	93	Weighted Average
	514		8.64% Pervious Area
	5,438		91.36% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Minimum Tc**

Summary for Pond 1P: Infiltration System 1

Inflow Area = 15,331 sf, 96.31% Impervious, Inflow Depth > 1.61"
Inflow = 1.13 cfs @ 12.08 hrs, Volume= 2,059 cf
Outflow = 0.12 cfs @ 12.75 hrs, Volume= 836 cf, Atten= 89%, Lag= 40.2 min
Discarded = 0.12 cfs @ 12.75 hrs, Volume= 836 cf
Primary = 0.00 cfs @ 11.00 hrs, Volume= 0 cf

Routing by Sim-Route method, Time Span= 11.00-13.00 hrs, dt= 0.01 hrs
Peak Elev= 220.03' @ 12.75 hrs Surf.Area= 2,219 sf Storage= 1,239 cf

Plug-Flow detention time= 19.6 min calculated for 836 cf (41% of inflow)
Center-of-Mass det. time= (not calculated: outflow precedes inflow)

Volume	Invert	Avail.Storage	Storage Description
#1A	219.00'	1,502 cf	**17.00'W x 130.50'L x 3.54'H Field A** 7,857 cf Overall - 2,850 cf Embedded = 5,007 cf x 30.0% Voids
#2A	219.50'	2,850 cf	**Cultec R-330XLHD** x 54 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 3 rows
		4,352 cf	Total Available Storage

Storage Group A created with Chamber Wizard

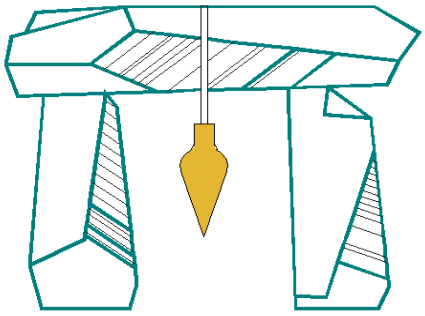
Device	Routing	Invert	Outlet Devices
#1	Discarded	219.00'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 1.00' Phase-In= 0.01'
#2	Primary	220.10'	**3.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.12 cfs @ 12.75 hrs HW=220.03' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.12 cfs)

Primary OutFlow Max=0.00 cfs @ 11.00 hrs HW=219.00' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Standard 4 Compliance (TSS Removal)

DeCelle-Burke-Sala



& Associates, Inc.

Project: **Proposed Multi-Unit Residential Developmemet**
Location: **91 Beatrice Circle Belmont, MA**
Date: **4/19/2020**

Subject: **TSS Removal Calculation**

BMP	TSS Removal	Start Load	Amount Removed	Remaining Load
Deep Sump Catch Basin w/ 12R Snout	25%	100%	25%	75%
CDS Water Quality Unit	50%	75%	38%	38%
Underground Recharge Chambers	80%	38%	30%	8%
Remaining Load		8%	0%	8%

DeCelle-Burke-Sala Associates, Inc.
1266 Furnace Brook Pkwy., #401 Quincy, MA 02169
PH:(617)-405-5100 FX:(617)-405-5101

Hydrodynamic Separation Product Calculator

91 Beatrice

91 Beatrice

CASCADE SEPARATOR CS-4

Project Information					
Project Name	91 Beatrice			**Option #**	A
Country	UNITED_STATES	**State**	Massachusetts	**City**	Belmont

Contact Information			
First Name	James	**Last Name**	Burke
Company	DeCelle-Burke-Sala & Associates, Inc.	**Phone #**	774-406-1889
Email	jburke@decelle-burke.com		

Design Criteria					
Site Designation	91 Beatrice			**Sizing Method**	Net Annual
Screening Required?	No	**Drainage Area (ac)**	0.35	**Peak Flow (cfs)**	2.79
Groundwater Depth (ft)	5 - 10	**Pipe Invert Depth (ft)**	0 - 5	**Bedrock Depth (ft)**	5 - 10
Multiple Inlets?	No	**Grate Inlet Required?**	No	**Pipe Size (in)**	12.00
Required Particle Size Distribution?	No	**90° between two inlets?**	N/A	**180° between inlet and outlet?**	No
Runoff Coefficient	0.90	**Rainfall Station**	69 - Boston Airport, MA	**TC (Min)**	6

Treatment Selection					
Treatment Unit	CASCADE SEPARATOR	**System Model**	CS-4		
Target Removal	50%	**Particle Size Distribution (PSD)**	110	**Predicted Net Annual Removal**	93.44%

*Treatment flow rate calculated using annualized weighted calculation.

CONTECH ENGINEERED SOLUTIONS

Hydrodynamic Separation Product Calculator

91 Beatrice

91 Beatrice

CASCADE SEPARATOR CS-4

CASCADE SEPARATOR ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION BASED ON THE RATIONAL RAINFALL METHOD								
Rainfall Intensity[1] (in/hr)	% Rainfall Volume[1]	Cumulative Rainfall Volume	Rainfall Volume Treated	Total Flowrate (cfs)	Treated Flowrate (cfs)	Hydraulic Loading Rate (%)	Removal Efficiency (%)	Incremental Removal (%)
0.0200	10.20%	10.20%	10.20%	0.0100	0.0100	0.36%	100.00%	10.17%
0.0400	9.70%	19.90%	9.70%	0.0100	0.0100	0.36%	100.00%	9.65%
0.0600	9.50%	29.40%	9.50%	0.0200	0.0200	0.71%	100.00%	9.45%
0.0800	7.70%	37.10%	7.70%	0.0300	0.0300	1.07%	100.00%	7.74%
0.1000	8.60%	45.70%	8.60%	0.0300	0.0300	1.07%	100.00%	8.57%
0.1200	6.30%	52.00%	6.30%	0.0400	0.0400	1.43%	100.00%	6.30%
0.1400	4.70%	56.70%	4.70%	0.0400	0.0400	1.43%	100.00%	4.66%
0.1600	4.60%	61.30%	4.60%	0.0500	0.0500	1.79%	100.00%	4.64%
0.1800	3.50%	64.80%	3.50%	0.0600	0.0600	2.14%	100.00%	3.54%
0.2000	4.30%	69.10%	4.30%	0.0600	0.0600	2.14%	100.00%	4.34%
0.2500	8.00%	77.10%	8.00%	0.0800	0.0800	2.86%	100.00%	8.00%
0.3000	5.60%	82.70%	5.60%	0.0900	0.0900	3.21%	100.00%	5.59%
0.3500	4.40%	87.10%	4.40%	0.1100	0.1100	3.93%	100.00%	4.37%
0.4000	2.50%	89.60%	2.50%	0.1300	0.1300	4.64%	100.00%	2.53%
0.4500	2.50%	92.10%	2.50%	0.1400	0.1400	5.00%	100.00%	2.53%
0.5000	1.40%	93.50%	1.40%	0.1600	0.1600	5.71%	100.00%	1.38%
0.7500	5.00%	98.50%	5.00%	0.2400	0.2400	8.57%	100.00%	5.04%
1.0000	1.00%	99.50%	1.00%	0.3200	0.3200	11.43%	100.00%	1.01%
1.5000	0.00%	99.50%	0.00%	0.4700	0.4700	16.78%	96.13%	0.00%
2.0000	0.00%	99.50%	0.00%	0.6300	0.6300	22.50%	90.75%	0.00%
3.0000	0.50%	100.00%	0.50%	0.9500	0.9500	33.92%	80.02%	0.38%
								99.89%
							Removal Efficiency Adjustment[2] =	6.45%
							Predicted % Annual Rainfall Treated =	93.55%
							Predicted Net Annual Load Removal Efficiency =	93.44%
1 - Based on 10 years of hourly precipitation data from NCDC Station 770, Boston WSFO AP, Suffolk County, MA								
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.								

*Treatment flow rate calculated using annualized weighted calculation.

SECTION (_____)
STORM WATER TREATMENT DEVICE

1.0 GENERAL

1.1 This item shall govern the furnishing and installation of the Cascade Separator™ by Contech Engineered Solutions LLC, complete and operable as shown and as specified herein, in accordance with the requirements of the plans and contract documents.

1.2 The Contractor shall furnish all labor, equipment and materials necessary to install the storm water treatment device(s) (SWTD) and appurtenances specified in the Drawings and these specifications.

1.3 The manufacturer of the SWTD shall be one that is regularly engaged in the engineering design and production of systems deployed for the treatment of storm water runoff for at least five (5) years and which have a history of successful production, acceptable to the Engineer. In accordance with the Drawings, the SWTD(s) shall be a Cascade Separator™ device manufactured by:

Contech Engineered Solutions LLC
9025 Centre Pointe Drive
West Chester, OH, 45069
Tel: 1 800 338 1122

1.4 Related Sections

1.4.1 Section 02240: Dewatering
1.4.2 Section 02260: Excavation Support and Protection
1.4.3 Section 02315: Excavation and Fill
1.4.4 Section 02340: Soil Stabilization

1.5 All components shall be subject to inspection by the engineer at the place of manufacture and/or installation. All components are subject to being rejected or identified for repair if the quality of materials and manufacturing do not comply with the requirements of this specification. Components which have been identified as defective may be subject for repair where final acceptance of the component is contingent on the discretion of the Engineer.

1.6 The manufacturer shall guarantee the SWTD components against all manufacturer originated defects in materials or workmanship for a period of twelve (12) months from the date the components are delivered to the owner for installation. The manufacturer shall upon its determination repair, correct or replace any manufacturer originated defects advised in writing to the manufacturer within the referenced warranty period. The use of SWTD components shall be limited to the application for which it was specifically designed.

1.7 The SWTD manufacturer shall submit to the Engineer of Record a “Manufacturer’s Performance Certification” certifying that each SWTD is capable of achieving the specified removal efficiencies listed in these specifications. The certification shall be supported by independent third-party research

1.8 No product substitutions shall be accepted unless submitted 10 days prior to project bid date, or as directed by the Engineer of Record. Submissions for substitutions require review and approval by the Engineer of Record, for hydraulic performance, impact to project designs, equivalent treatment performance, and any required project plan and report (hydrology/hydraulic, water quality, stormwater pollution) modifications that would be required by the approving jurisdictions/agencies. Contractor to coordinate with the Engineer of Record any applicable modifications to the project estimates of cost, bonding amount determinations, plan check fees for changes to approved documents, and/or any other regulatory requirements resulting from the product substitution.

2.0 MATERIALS

2.1 Housing unit of stormwater treatment device shall be constructed of pre-cast or cast-in-place concrete, no exceptions. Precast concrete components shall conform to applicable sections of ASTM C 478, ASTM C 857 and ASTM C 858 and the following:

- 2.1.1 Concrete shall achieve a minimum 28-day compressive strength of 4,000 pounds per square-inch (psi);
- 2.1.2 Unless otherwise noted, the precast concrete sections shall be designed to withstand lateral earth and AASHTO H-20 traffic loads;
- 2.1.3 Cement shall be Type III Portland Cement conforming to ASTM C 150;
- 2.1.4 Aggregates shall conform to ASTM C 33;
- 2.1.5 Reinforcing steel shall be deformed billet-steel bars, welded steel wire or deformed welded steel wire conforming to ASTM A 615, A 185, or A 497.
- 2.1.6 Joints shall be sealed with preformed joint sealing compound conforming to ASTM C 990.
- 2.1.7 Shipping of components shall not be initiated until a minimum compressive strength of 4,000 psi is attained or five (5) calendar days after fabrication has expired, whichever occurs first.

2.2 Internal Components and appurtenances shall conform to the following:

- 2.2.1 Hardware shall be manufactured of Type 316 stainless steel conforming to ASTM A 320;
- 2.2.2 Support brackets shall be manufactured of 5052 Aluminum
- 2.2.3 Fiberglass components shall conform to applicable sections of ASTM D-4097
- 2.2.4 Access system(s) conform to the following:
- 2.2.5 Manhole castings shall be designed to withstand AASHTO H-20 loadings and manufactured of cast-iron conforming to ASTM A 48 Class 30.

3.0 PERFORMANCE

3.1 The SWTD shall be capable of achieving an annualized weighted reduction of at least 80% of the OK-110 particle distribution having particles ranging from 53 microns to 212 microns with a d_{50} of approximately 110 microns unless otherwise stated.

3.2 The SWTD shall be designed with a sump chamber for the storage of captured sediments and other negatively buoyant pollutants in between maintenance cycles. The minimum storage capacity provided by the sump chamber shall be in accordance with the volume listed in Table 1. The boundaries of the sump chamber shall be limited to that which do not degrade the

SWTD's treatment efficiency as captured pollutants accumulate. In order to not restrict the Owner's ability to maintain the SWTD, the minimum dimension providing access from the ground surface to the sump chamber shall be 16 inches in diameter.

3.3 The SWTD shall be designed to capture and retain Total Petroleum Hydrocarbons generated by wet-weather flow and dry-weather gross spills and have a capacity listed in Table 1 of the required unit.

3.4 The SWTD shall convey the flow from the peak storm event of the drainage network, in accordance with required hydraulic upstream conditions as defined by the Engineer. If a substitute SWTD is proposed, supporting documentation shall be submitted that demonstrates equal or better upstream hydraulic conditions compared to that specified herein. This documentation shall be signed and sealed by a Professional Engineer registered in the State of the work. All costs associated with preparing and certifying this documentation shall be born solely by the Contractor.

4.0 EXECUTION

4.1 The contractor shall exercise care in the storage and handling of the SWTD components prior to and during installation. Any repair or replacement costs associated with events occurring after delivery is accepted and unloading has commenced shall be borne by the contractor.

4.2 The SWTD shall be installed in accordance with the manufacturer's recommendations and related sections of the contract documents. The manufacturer shall provide the contractor installation instructions and offer on-site guidance during the important stages of the installation as identified by the manufacturer at no additional expense. A minimum of 72 hours notice shall be provided to the manufacturer prior to their performance of the services included under this subsection.

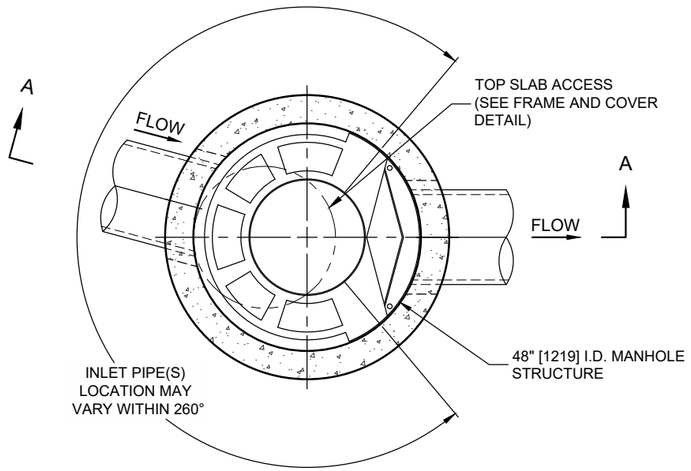
4.3 The contractor shall fill all voids associated with lifting provisions provided by the manufacturer. These voids shall be filled with non-shrinking grout providing a finished surface consistent with adjacent surfaces. The contractor shall trim all protruding lifting provisions flush with the adjacent concrete surface in a manner, which leaves no sharp points or edges.

4.4 The contractor shall removal all loose material and pooling water from the SWTD prior to the transfer of operational responsibility to the Owner.

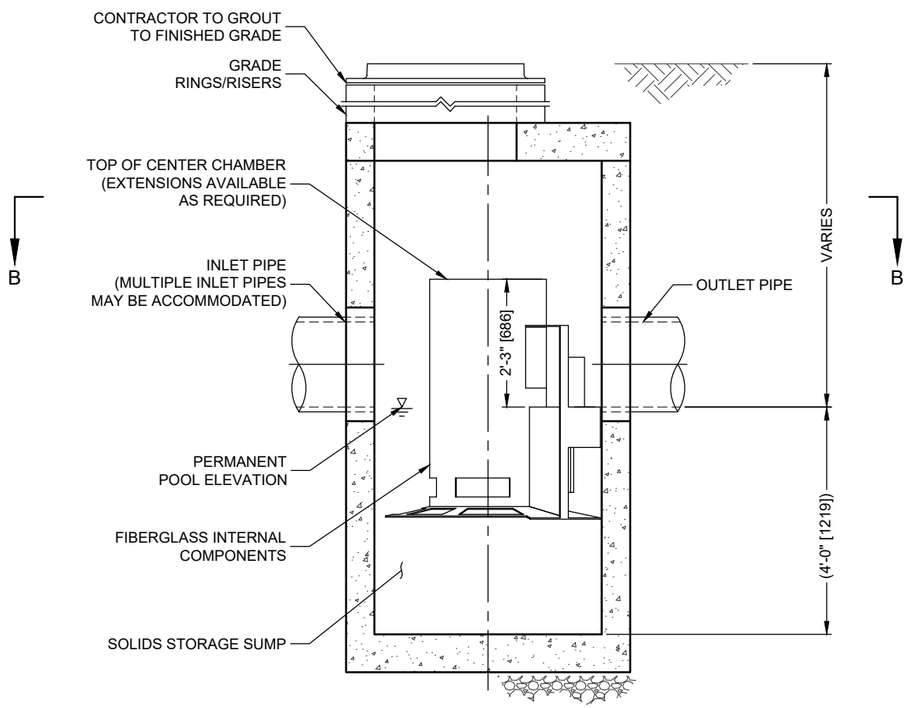
TABLE 1: Storm Water Treatment Device Storage Capacities

Cascade Model	Minimum Sump Storage Capacity (yd^3)	Minimum Oil Storage Capacity (gal)
CS-4	0.70	141.0
CS-5	1.09	269.3
CS-6	1.57	475.9
CS-8	2.79	1128.0
CS-10	4.36	2203.2
CS-12	6.28	3807.1

END OF SECTION



PLAN VIEW B-B
NOT TO SCALE



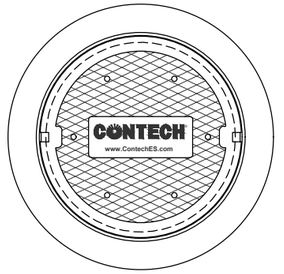
ELEVATION A-A
NOT TO SCALE

CASCADE
separator™

CASCADE SEPARATOR DESIGN NOTES

THE STANDARD CS-4 CONFIGURATION IS SHOWN. ALTERNATE CONFIGURATIONS ARE AVAILABLE AND ARE LISTED BELOW. SOME CONFIGURATIONS MAY BE COMBINED TO SUIT SITE REQUIREMENTS.

CONFIGURATION DESCRIPTION
GRATED INLET ONLY (NO INLET PIPE)
GRATED INLET WITH INLET PIPE OR PIPES
CURB INLET ONLY (NO INLET PIPE)
CURB INLET WITH INLET PIPE OR PIPES



FRAME AND COVER
(DIAMETER VARIES)
NOT TO SCALE

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID	
WATER QUALITY FLOW RATE (cfs [L/s])	
PEAK FLOW RATE (cfs [L/s])	
RETURN PERIOD OF PEAK FLOW (yrs)	
RIM ELEVATION	

PIPE DATA:	INVERT	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2			
OUTLET PIPE			

NOTES / SPECIAL REQUIREMENTS:

GENERAL NOTES
1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. FOR SITE SPECIFIC DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHT, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.ContechES.com
3. CASCADE SEPARATOR WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING. CONTRACTOR TO CONFIRM STRUCTURE MEETS REQUIREMENTS OF PROJECT.
4. CASCADE SEPARATOR STRUCTURE SHALL MEET AASHTO HS20 LOAD RATING, ASSUMING EARTH COVER OF 0' - 2' [610], AND GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CASTINGS SHALL MEET AASHTO M306 AND BE CAST WITH THE CONTECH LOGO.
5. CASCADE SEPARATOR STRUCTURE SHALL BE PRECAST CONCRETE CONFORMING TO ASTM C478 AND AASHTO LOAD FACTOR DESIGN METHOD.
6. ALTERNATE UNITS ARE SHOWN IN MILLIMETERS [mm].

INSTALLATION NOTES
A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE CASCADE SEPARATOR MANHOLE STRUCTURE.
C. CONTRACTOR TO INSTALL JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS AND ASSEMBLE STRUCTURE.
D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT INLET AND OUTLET PIPE(S). MATCH PIPE INVERTS WITH ELEVATIONS SHOWN. ALL PIPE CENTERLINES TO MATCH PIPE OPENING CENTERLINES.
E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

CONTECH
ENGINEERED SOLUTIONS LLC
www.contechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CS-4
CASCADE SEPARATOR
STANDARD DETAIL

Pipe Sizing (Rational Method)

Project: **91 Beatrice Circle**
Belmont, MA
Client: **91 Beatrice Circle LLC**

Date: **4/19/21**

Prepared by: **DeCelle-Burke-Sala & Associates, Inc.**
1266 Furnace Brook Parkway, #401
Quincy, MA 02169
617-405-5100

DeCelle-Burke-Sala & Associates, Inc.

DRAINAGE CALCULATIONS FOR A 25-YEAR STORM, CHEZY-MANNING'S FORMULA, N=0.011, HDPE PIPE

STRUCTURE		DESC.	AREA	"C"	CA	TIME (min.)		I	Q	L	S	DIA.	QFULL	VFULL	Q/	V/	V	D/V	RIM	INVERT	INVERT
from	to		(acres)		(acres)	PIPE	Tc	(in/hr)	(cfs)	(ft)	(ft/ft)	(in.)	(cfs)	(ft/s)	QFULL	VFULL	(ft/s)	(min.)		IN	OUT
A6	CB1	PAVE	0.04	0.90	0.03																
		GRASS	0.00	0.35	0.00																
CB1	DMH1		0.04	0.88	0.03		5.00	6.57	0.22	42.00	0.01	10.00	1.84	3.37	0.12	0.65	2.19	0.32		221.5	221.3
A8	CB2	PAVE	0.12	0.90	0.11																
		GRASS	0.01	0.35	0.00																
CB2	DMH1		0.14	0.85	0.12		5.00	6.57	0.77	16.00	0.04	10.00	5.45	9.99	0.14	0.70	6.99	0.04		222.0	221.3
DMH1	CDS		0.17	0.86	0.15	0.32	5.32	6.51	0.97	15.00	0.01	10.00	2.96	5.43	0.33	0.88	4.78	0.05		221.2	221.0
DMH2	DMH3								0.58	95.00	0.08	10.00	6.17	11.32	0.09	0.60	6.79	0.23		219.5	212.0

Groundwater Mounding

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi(0), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.
Cells highlighted in yellow are values that can be changed by the user. Cells highlighted in red are output values based on user-specified inputs. The user MUST click the blue "Re-Calculate Now" button each time ANY of the user-specified inputs are changed otherwise necessary iterations to converge on the correct solution will not be done and values shown will be incorrect. Use consistent units for all input values (for example, feet and days)

use consistent units (e.g. feet & days **or** inches & hours)

Conversion Table

inch/hour	**feet/day**
0.67	1.33
2.00	4.00

hours	**days**
36	1.50

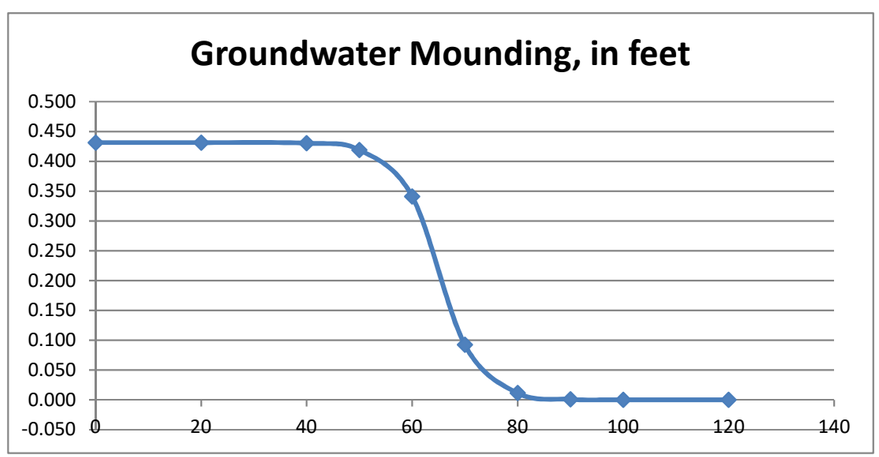
In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

Input Values		
1.0000	***R***	**Recharge (infiltration) rate (feet/day)**
0.330	**Sy**	**Specific yield, Sy (dimensionless, between 0 and 1)**
48.20	**K**	**Horizontal hydraulic conductivity, Kh (feet/day)***
65.000	**x**	**1/2 length of basin (x direction, in feet)**
7.880	**y**	**1/2 width of basin (y direction, in feet)**
0.200	**t**	**duration of infiltration period (days)**
2.000	**hi(0)**	**initial thickness of saturated zone (feet)**

2.431	**h(max)**	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
0.431	**Δh(max)**	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

Ground-water Mounding, in feet	**Distance from center of basin in x direction, in feet**
0.431	**0**
0.431	**20**
0.430	**40**
0.419	**50**
0.341	**60**
0.092	**70**
0.011	**80**
0.001	**90**
0.000	**100**
0.000	**120**

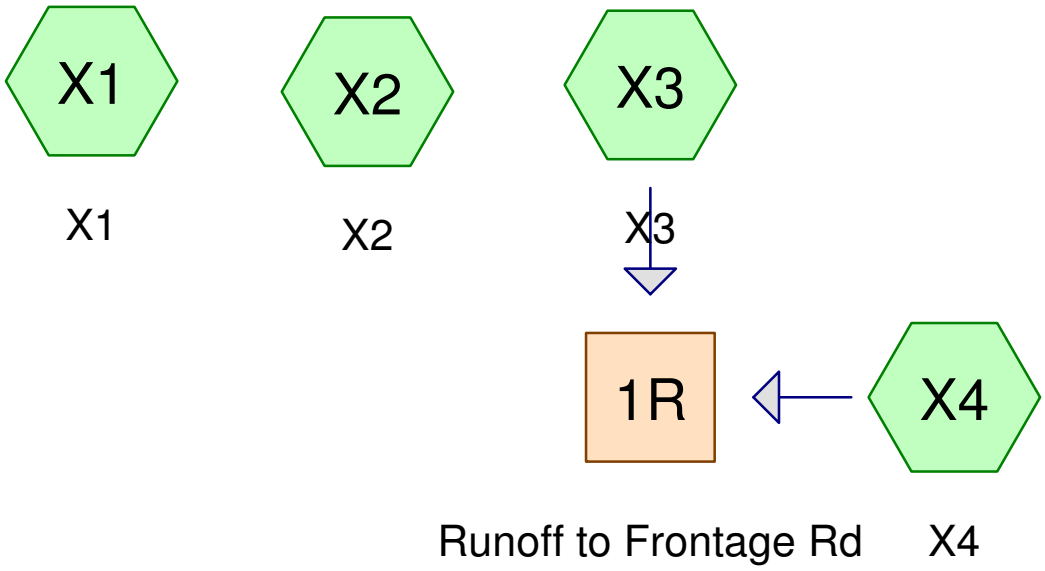
Re-Calculate Now



Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

HydroCAD Calculations
Existing Conditions
2-Year
10-Year
25-Year
100-Year



Subcat Reach Pond Link

Routing Diagram for Drainage 04-19-21
Prepared by DeCelle-Burke-Sala & Associates, Inc., Printed 4/21/2021
HydroCAD® 10.00-25 s/n 07920 © 2019 HydroCAD Software Solutions LLC

Area Listing (selected nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
18,952	49	50-75% Grass cover, Fair, HSG A (X1, X2, X3, X4)
4,565	98	Pavement (X2, X3, X4)
3,553	98	Roof (X1, X2, X3)
5,009	36	Woods, Fair, HSG A (X2, X4)
32,079	**59**	**TOTAL AREA**

Summary for Subcatchment X1: X1

Runoff = 0.01 cfs @ 12.39 hrs, Volume= 123 cf, Depth= 0.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.27"

	Area (sf)	CN	Description
*	414	98	Roof
	7,367	49	50-75% Grass cover, Fair, HSG A
	7,781	52	Weighted Average
	7,367		94.68% Pervious Area
	414		5.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment X2: X2

Runoff = 0.12 cfs @ 12.11 hrs, Volume= 509 cf, Depth= 0.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.27"

	Area (sf)	CN	Description
*	1,494	98	Pavement
*	2,198	98	Roof
	5,727	49	50-75% Grass cover, Fair, HSG A
	1,663	36	Woods, Fair, HSG A
	11,082	63	Weighted Average
	7,390		66.68% Pervious Area
	3,692		33.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Minimum Tc**

Summary for Subcatchment X3: X3

Runoff = 0.05 cfs @ 12.11 hrs, Volume= 213 cf, Depth= 0.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.27"

	Area (sf)	CN	Description
*	370	98	Pavement
*	941	98	Roof
	3,323	49	50-75% Grass cover, Fair, HSG A
	4,634	63	Weighted Average
	3,323		71.71% Pervious Area
	1,311		28.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment X4: X4

Runoff = 0.05 cfs @ 12.13 hrs, Volume= 286 cf, Depth= 0.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.27"

	Area (sf)	CN	Description
*	2,701	98	Pavement
	2,535	49	50-75% Grass cover, Fair, HSG A
	3,346	36	Woods, Fair, HSG A
	8,582	59	Weighted Average
	5,881		68.53% Pervious Area
	2,701		31.47% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Reach 1R: Runoff to Frontage Rd

Inflow Area = 13,216 sf, 30.36% Impervious, Inflow Depth = 0.45" for 2-yr event
Inflow = 0.10 cfs @ 12.12 hrs, Volume= 499 cf
Outflow = 0.10 cfs @ 12.13 hrs, Volume= 499 cf, Atten= 0%, Lag= 0.6 min

Routing by Sim-Route method, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs

Summary for Subcatchment X1: X1

Runoff = 0.13 cfs @ 12.11 hrs, Volume= 568 cf, Depth= 0.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=5.16"

	Area (sf)	CN	Description
*	414	98	Roof
	7,367	49	50-75% Grass cover, Fair, HSG A
	7,781	52	Weighted Average
	7,367		94.68% Pervious Area
	414		5.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment X2: X2

Runoff = 0.45 cfs @ 12.10 hrs, Volume= 1,488 cf, Depth= 1.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=5.16"

	Area (sf)	CN	Description
*	1,494	98	Pavement
*	2,198	98	Roof
	5,727	49	50-75% Grass cover, Fair, HSG A
	1,663	36	Woods, Fair, HSG A
	11,082	63	Weighted Average
	7,390		66.68% Pervious Area
	3,692		33.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Minimum Tc**

Summary for Subcatchment X3: X3

Runoff = 0.19 cfs @ 12.10 hrs, Volume= 622 cf, Depth= 1.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=5.16"

	Area (sf)	CN	Description
*	370	98	Pavement
*	941	98	Roof
	3,323	49	50-75% Grass cover, Fair, HSG A
	4,634	63	Weighted Average
	3,323		71.71% Pervious Area
	1,311		28.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment X4: X4

Runoff = 0.27 cfs @ 12.10 hrs, Volume= 948 cf, Depth= 1.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=5.16"

	Area (sf)	CN	Description
*	2,701	98	Pavement
	2,535	49	50-75% Grass cover, Fair, HSG A
	3,346	36	Woods, Fair, HSG A
	8,582	59	Weighted Average
	5,881		68.53% Pervious Area
	2,701		31.47% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Reach 1R: Runoff to Frontage Rd

Inflow Area = 13,216 sf, 30.36% Impervious, Inflow Depth = 1.43" for 10-yr event
Inflow = 0.46 cfs @ 12.10 hrs, Volume= 1,571 cf
Outflow = 0.46 cfs @ 12.11 hrs, Volume= 1,571 cf, Atten= 0%, Lag= 0.6 min

Routing by Sim-Route method, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs

Summary for Subcatchment X1: X1

Runoff = 0.27 cfs @ 12.10 hrs, Volume= 954 cf, Depth= 1.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr Rainfall=6.34"

	Area (sf)	CN	Description
*	414	98	Roof
	7,367	49	50-75% Grass cover, Fair, HSG A
	7,781	52	Weighted Average
	7,367		94.68% Pervious Area
	414		5.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment X2: X2

Runoff = 0.70 cfs @ 12.09 hrs, Volume= 2,232 cf, Depth= 2.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr Rainfall=6.34"

	Area (sf)	CN	Description
*	1,494	98	Pavement
*	2,198	98	Roof
	5,727	49	50-75% Grass cover, Fair, HSG A
	1,663	36	Woods, Fair, HSG A
	11,082	63	Weighted Average
	7,390		66.68% Pervious Area
	3,692		33.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Minimum Tc**

Summary for Subcatchment X3: X3

Runoff = 0.29 cfs @ 12.09 hrs, Volume= 933 cf, Depth= 2.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr Rainfall=6.34"

	Area (sf)	CN	Description
*	370	98	Pavement
*	941	98	Roof
	3,323	49	50-75% Grass cover, Fair, HSG A
	4,634	63	Weighted Average
	3,323		71.71% Pervious Area
	1,311		28.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment X4: X4

Runoff = 0.45 cfs @ 12.10 hrs, Volume= 1,473 cf, Depth= 2.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr Rainfall=6.34"

	Area (sf)	CN	Description
*	2,701	98	Pavement
	2,535	49	50-75% Grass cover, Fair, HSG A
	3,346	36	Woods, Fair, HSG A
	8,582	59	Weighted Average
	5,881		68.53% Pervious Area
	2,701		31.47% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Reach 1R: Runoff to Frontage Rd

Inflow Area = 13,216 sf, 30.36% Impervious, Inflow Depth = 2.18" for 25-yr event
Inflow = 0.74 cfs @ 12.09 hrs, Volume= 2,406 cf
Outflow = 0.74 cfs @ 12.10 hrs, Volume= 2,406 cf, Atten= 0%, Lag= 0.6 min

Routing by Sim-Route method, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs

Summary for Subcatchment X1: X1

Runoff = 0.50 cfs @ 12.10 hrs, Volume= 1,659 cf, Depth= 2.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=8.15"

	Area (sf)	CN	Description
*	414	98	Roof
	7,367	49	50-75% Grass cover, Fair, HSG A
	7,781	52	Weighted Average
	7,367		94.68% Pervious Area
	414		5.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment X2: X2

Runoff = 1.12 cfs @ 12.09 hrs, Volume= 3,497 cf, Depth= 3.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=8.15"

	Area (sf)	CN	Description
*	1,494	98	Pavement
*	2,198	98	Roof
	5,727	49	50-75% Grass cover, Fair, HSG A
	1,663	36	Woods, Fair, HSG A
	11,082	63	Weighted Average
	7,390		66.68% Pervious Area
	3,692		33.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Minimum Tc**

Summary for Subcatchment X3: X3

Runoff = 0.47 cfs @ 12.09 hrs, Volume= 1,462 cf, Depth= 3.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=8.15"

	Area (sf)	CN	Description
*	370	98	Pavement
*	941	98	Roof
	3,323	49	50-75% Grass cover, Fair, HSG A
	4,634	63	Weighted Average
	3,323		71.71% Pervious Area
	1,311		28.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment X4: X4

Runoff = 0.76 cfs @ 12.09 hrs, Volume= 2,384 cf, Depth= 3.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=8.15"

	Area (sf)	CN	Description
*	2,701	98	Pavement
	2,535	49	50-75% Grass cover, Fair, HSG A
	3,346	36	Woods, Fair, HSG A
	8,582	59	Weighted Average
	5,881		68.53% Pervious Area
	2,701		31.47% Impervious Area

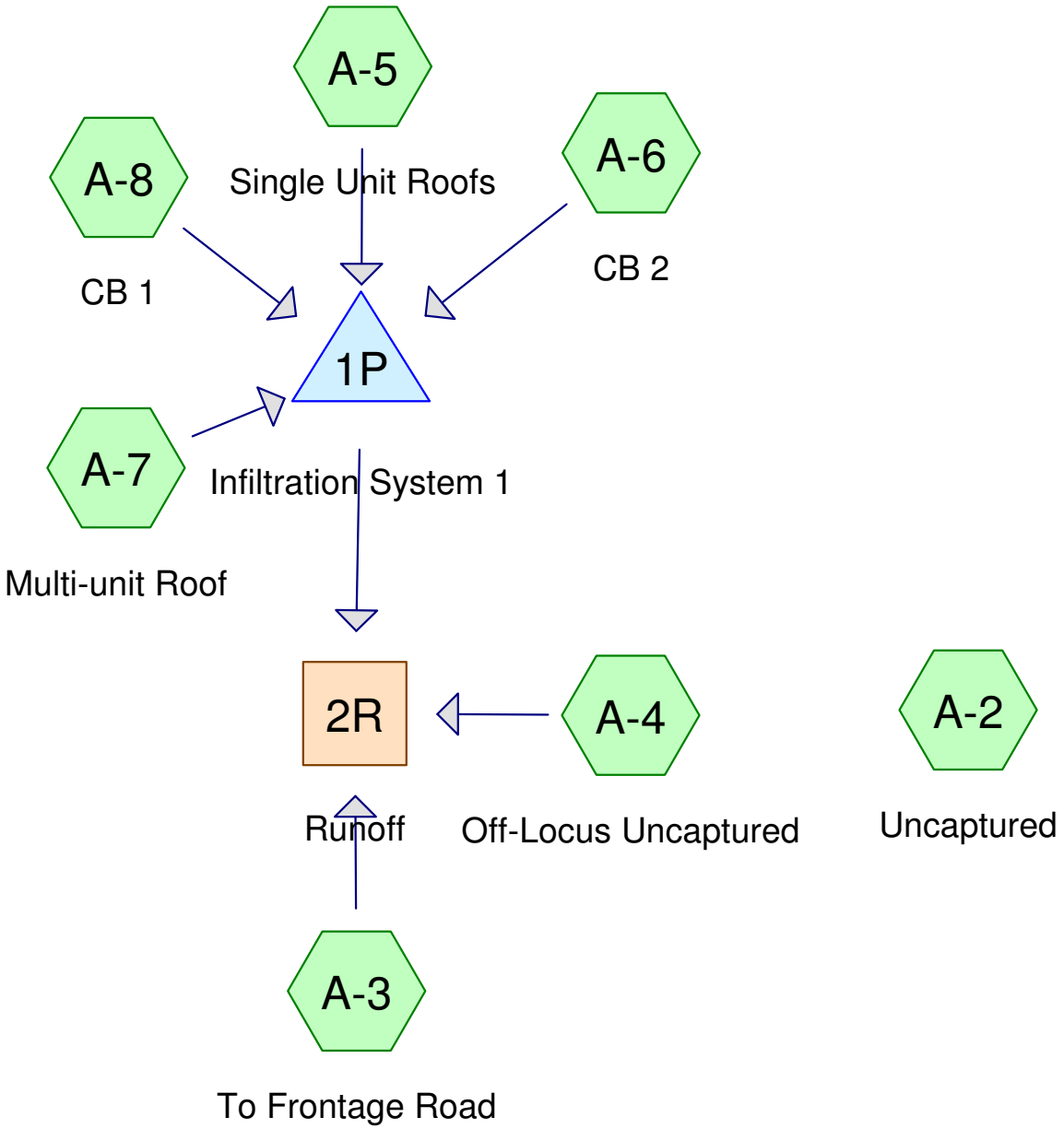
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Reach 1R: Runoff to Frontage Rd

Inflow Area = 13,216 sf, 30.36% Impervious, Inflow Depth = 3.49" for 100-yr event
Inflow = 1.23 cfs @ 12.09 hrs, Volume= 3,846 cf
Outflow = 1.23 cfs @ 12.10 hrs, Volume= 3,846 cf, Atten= 0%, Lag= 0.6 min

Routing by Sim-Route method, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs

HydroCAD Calculations
Proposed Conditions
2-Year
10-Year
25-Year
100-Year



Subcat Reach Pond Link

Routing Diagram for Drainage 04-19-21
Prepared by DeCelle-Burke-Sala & Associates, Inc., Printed 4/22/2021

Area Listing (selected nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
9,101	39	>75% Grass cover, Good, HSG A (A-2, A-3, A-4, A-6, A-8)
11,340	98	Paved parking (A-3, A-4, A-6, A-8)
7,759	98	Roofs (A-5, A-7)
3,879	30	Woods, Good, HSG A (A-2, A-4)
32,079	**73**	**TOTAL AREA**

Summary for Subcatchment A-2: Uncaptured

Runoff = 0.00 cfs @ 24.03 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.27"

Area (sf)	CN	Description
5,123	39	>75% Grass cover, Good, HSG A
533	30	Woods, Good, HSG A
5,656	38	Weighted Average
5,656		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Minimum Tc**

Summary for Subcatchment A-3: To Frontage Road

Runoff = 0.10 cfs @ 12.09 hrs, Volume= 305 cf, Depth= 1.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.27"

	Area (sf)	CN	Description
*	1,760	98	Paved parking
	750	39	>75% Grass cover, Good, HSG A
	2,510	80	Weighted Average
	750		29.88% Pervious Area
	1,760		70.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Minimum Tc**

Summary for Subcatchment A-4: Off-Locus Uncaptured

Runoff = 0.02 cfs @ 12.37 hrs, Volume= 155 cf, Depth= 0.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.27"

	Area (sf)	CN	Description
*	2,573	98	Paved parking
	2,663	39	>75% Grass cover, Good, HSG A
	3,346	30	Woods, Good, HSG A
	8,582	53	Weighted Average
	6,009		70.02% Pervious Area
	2,573		29.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment A-5: Single Unit Roofs

Runoff = 0.25 cfs @ 12.08 hrs, Volume= 870 cf, Depth= 3.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.27"

	Area (sf)	CN	Description
*	3,438	98	Roofs
	3,438		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Minimum Tc**

Summary for Subcatchment A-6: CB 2

Runoff = 0.11 cfs @ 12.08 hrs, Volume= 380 cf, Depth= 2.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.27"

	Area (sf)	CN	Description
*	1,569	98	Paved parking
	51	39	>75% Grass cover, Good, HSG A
	1,620	96	Weighted Average
	51		3.15% Pervious Area
	1,569		96.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Minimum Tc**

Summary for Subcatchment A-7: Multi-unit Roof

Runoff = 0.32 cfs @ 12.08 hrs, Volume= 1,094 cf, Depth= 3.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.27"

	Area (sf)	CN	Description
*	4,321	98	Roofs
	4,321		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Minimum Tc**

Summary for Subcatchment A-8: CB 1

Runoff = 0.39 cfs @ 12.09 hrs, Volume= 1,246 cf, Depth= 2.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.27"

	Area (sf)	CN	Description
*	5,438	98	Paved parking
	514	39	>75% Grass cover, Good, HSG A
	5,952	93	Weighted Average
	514		8.64% Pervious Area
	5,438		91.36% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Minimum Tc**

Summary for Reach 2R: Runoff

Inflow Area = 26,423 sf, 72.28% Impervious, Inflow Depth = 0.21" for 2-yr event
Inflow = 0.10 cfs @ 12.09 hrs, Volume= 459 cf
Outflow = 0.10 cfs @ 12.10 hrs, Volume= 459 cf, Atten= 0%, Lag= 0.6 min

Routing by Sim-Route method, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: Infiltration System 1

Inflow Area = 15,331 sf, 96.31% Impervious, Inflow Depth = 2.81" for 2-yr event
Inflow = 1.07 cfs @ 12.08 hrs, Volume= 3,591 cf
Outflow = 0.11 cfs @ 12.78 hrs, Volume= 3,591 cf, Atten= 89%, Lag= 41.9 min
Discarded = 0.11 cfs @ 12.78 hrs, Volume= 3,591 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Sim-Route method, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Peak Elev= 220.05' @ 12.78 hrs Surf.Area= 2,048 sf Storage= 1,185 cf

Plug-Flow detention time= 69.7 min calculated for 3,589 cf (100% of inflow)
Center-of-Mass det. time= 69.7 min (839.9 - 770.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	219.00'	1,277 cf	**15.75'W x 130.00'L x 3.21'H Field A** 6,569 cf Overall - 2,313 cf Embedded = 4,256 cf x 30.0% Voids
#2A	219.50'	2,313 cf	**Cultec R-280HD** x 54 Inside #1 Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap Row Length Adjustment= +1.00' x 6.07 sf x 3 rows
#3	221.50'	2,815 cf	**4.00'D x 224.00'H Vertical Cone/Cylinder**
#4	224.00'	1,146 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
		7,551 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
224.00	0	0	0
225.00	2,292	1,146	1,146

Device	Routing	Invert	Outlet Devices
#1	Discarded	219.00'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 1.00' Phase-In= 0.01'
#2	Primary	220.10'	**3.0" Vert. Orifice/Grate** C= 0.600
#3	Primary	224.83'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 0.5' Crest Height

Discarded OutFlow Max=0.11 cfs @ 12.78 hrs HW=220.05' (Free Discharge)
└**1=Exfiltration** (Controls 0.11 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=219.00' TW=0.00' (Dynamic Tailwater)
├**2=Orifice/Grate** (Controls 0.00 cfs)
└**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Subcatchment A-2: Uncaptured

Runoff = 0.00 cfs @ 12.49 hrs, Volume= 93 cf, Depth= 0.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=5.16"

Area (sf)	CN	Description
5,123	39	>75% Grass cover, Good, HSG A
533	30	Woods, Good, HSG A
5,656	38	Weighted Average
5,656		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Minimum Tc**

Summary for Subcatchment A-3: To Frontage Road

Runoff = 0.20 cfs @ 12.09 hrs, Volume= 634 cf, Depth= 3.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=5.16"

	Area (sf)	CN	Description
*	1,760	98	Paved parking
	750	39	>75% Grass cover, Good, HSG A
	2,510	80	Weighted Average
	750		29.88% Pervious Area
	1,760		70.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Minimum Tc**

Summary for Subcatchment A-4: Off-Locus Uncaptured

Runoff = 0.17 cfs @ 12.11 hrs, Volume= 669 cf, Depth= 0.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=5.16"

	Area (sf)	CN	Description
*	2,573	98	Paved parking
	2,663	39	>75% Grass cover, Good, HSG A
	3,346	30	Woods, Good, HSG A
	8,582	53	Weighted Average
	6,009		70.02% Pervious Area
	2,573		29.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment A-5: Single Unit Roofs

Runoff = 0.40 cfs @ 12.08 hrs, Volume= 1,410 cf, Depth= 4.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=5.16"

	Area (sf)	CN	Description
*	3,438	98	Roofs
	3,438		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Minimum Tc**

Summary for Subcatchment A-6: CB 2

Runoff = 0.18 cfs @ 12.08 hrs, Volume= 633 cf, Depth= 4.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=5.16"

	Area (sf)	CN	Description
*	1,569	98	Paved parking
	51	39	>75% Grass cover, Good, HSG A
	1,620	96	Weighted Average
	51		3.15% Pervious Area
	1,569		96.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Minimum Tc**

Summary for Subcatchment A-7: Multi-unit Roof

Runoff = 0.50 cfs @ 12.08 hrs, Volume= 1,773 cf, Depth= 4.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=5.16"

	Area (sf)	CN	Description
*	4,321	98	Roofs
	4,321		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Minimum Tc**

Summary for Subcatchment A-8: CB 1

Runoff = 0.65 cfs @ 12.08 hrs, Volume= 2,160 cf, Depth= 4.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=5.16"

	Area (sf)	CN	Description
*	5,438	98	Paved parking
	514	39	>75% Grass cover, Good, HSG A
	5,952	93	Weighted Average
	514		8.64% Pervious Area
	5,438		91.36% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Minimum Tc**

Summary for Reach 2R: Runoff

Inflow Area = 26,423 sf, 72.28% Impervious, Inflow Depth = 1.00" for 10-yr event
Inflow = 0.37 cfs @ 12.10 hrs, Volume= 2,199 cf
Outflow = 0.37 cfs @ 12.11 hrs, Volume= 2,199 cf, Atten= 0%, Lag= 0.6 min

Routing by Sim-Route method, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: Infiltration System 1

Inflow Area = 15,331 sf, 96.31% Impervious, Inflow Depth = 4.68" for 10-yr event
Inflow = 1.74 cfs @ 12.08 hrs, Volume= 5,977 cf
Outflow = 0.27 cfs @ 12.57 hrs, Volume= 5,977 cf, Atten= 85%, Lag= 29.2 min
Discarded = 0.12 cfs @ 12.57 hrs, Volume= 5,081 cf
Primary = 0.15 cfs @ 12.57 hrs, Volume= 895 cf

Routing by Sim-Route method, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Peak Elev= 220.63' @ 12.57 hrs Surf.Area= 2,048 sf Storage= 2,067 cf

Plug-Flow detention time= 88.5 min calculated for 5,974 cf (100% of inflow)
Center-of-Mass det. time= 88.4 min (848.2 - 759.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	219.00'	1,277 cf	**15.75'W x 130.00'L x 3.21'H Field A** 6,569 cf Overall - 2,313 cf Embedded = 4,256 cf x 30.0% Voids
#2A	219.50'	2,313 cf	**Cultec R-280HD** x 54 Inside #1 Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap Row Length Adjustment= +1.00' x 6.07 sf x 3 rows
#3	221.50'	2,815 cf	**4.00'D x 224.00'H Vertical Cone/Cylinder**
#4	224.00'	1,146 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
		7,551 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
224.00	0	0	0
225.00	2,292	1,146	1,146

Device	Routing	Invert	Outlet Devices
#1	Discarded	219.00'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 1.00' Phase-In= 0.01'
#2	Primary	220.10'	**3.0" Vert. Orifice/Grate** C= 0.600
#3	Primary	224.83'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 0.5' Crest Height

Discarded OutFlow Max=0.12 cfs @ 12.57 hrs HW=220.63' (Free Discharge)
└**1=Exfiltration** (Controls 0.12 cfs)

Primary OutFlow Max=0.15 cfs @ 12.57 hrs HW=220.63' TW=0.00' (Dynamic Tailwater)
├**2=Orifice/Grate** (Orifice Controls 0.15 cfs @ 3.08 fps)
└**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Subcatchment A-2: Uncaptured

Runoff = 0.03 cfs @ 12.34 hrs, Volume= 230 cf, Depth= 0.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr Rainfall=6.34"

Area (sf)	CN	Description
5,123	39	>75% Grass cover, Good, HSG A
533	30	Woods, Good, HSG A
5,656	38	Weighted Average
5,656		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Minimum Tc**

Summary for Subcatchment A-3: To Frontage Road

Runoff = 0.27 cfs @ 12.09 hrs, Volume= 855 cf, Depth= 4.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr Rainfall=6.34"

	Area (sf)	CN	Description
*	1,760	98	Paved parking
	750	39	>75% Grass cover, Good, HSG A
	2,510	80	Weighted Average
	750		29.88% Pervious Area
	1,760		70.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Minimum Tc**

Summary for Subcatchment A-4: Off-Locus Uncaptured

Runoff = 0.32 cfs @ 12.10 hrs, Volume= 1,110 cf, Depth= 1.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr Rainfall=6.34"

	Area (sf)	CN	Description
*	2,573	98	Paved parking
	2,663	39	>75% Grass cover, Good, HSG A
	3,346	30	Woods, Good, HSG A
	8,582	53	Weighted Average
	6,009		70.02% Pervious Area
	2,573		29.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment A-5: Single Unit Roofs

Runoff = 0.49 cfs @ 12.08 hrs, Volume= 1,748 cf, Depth= 6.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr Rainfall=6.34"

	Area (sf)	CN	Description
*	3,438	98	Roofs
	3,438		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Minimum Tc**

Summary for Subcatchment A-6: CB 2

Runoff = 0.23 cfs @ 12.08 hrs, Volume= 792 cf, Depth= 5.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr Rainfall=6.34"

	Area (sf)	CN	Description
*	1,569	98	Paved parking
	51	39	>75% Grass cover, Good, HSG A
	1,620	96	Weighted Average
	51		3.15% Pervious Area
	1,569		96.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Minimum Tc**

Summary for Subcatchment A-7: Multi-unit Roof

Runoff = 0.62 cfs @ 12.08 hrs, Volume= 2,197 cf, Depth= 6.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr Rainfall=6.34"

	Area (sf)	CN	Description
*	4,321	98	Roofs
	4,321		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Minimum Tc**

Summary for Subcatchment A-8: CB 1

Runoff = 0.82 cfs @ 12.08 hrs, Volume= 2,737 cf, Depth= 5.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-yr Rainfall=6.34"

	Area (sf)	CN	Description
*	5,438	98	Paved parking
	514	39	>75% Grass cover, Good, HSG A
	5,952	93	Weighted Average
	514		8.64% Pervious Area
	5,438		91.36% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Minimum Tc**

Summary for Reach 2R: Runoff

Inflow Area = 26,423 sf, 72.28% Impervious, Inflow Depth = 1.68" for 25-yr event
Inflow = 0.67 cfs @ 12.11 hrs, Volume= 3,703 cf
Outflow = 0.67 cfs @ 12.12 hrs, Volume= 3,703 cf, Atten= 0%, Lag= 0.6 min

Routing by Sim-Route method, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: Infiltration System 1

Inflow Area = 15,331 sf, 96.31% Impervious, Inflow Depth = 5.85" for 25-yr event
Inflow = 2.15 cfs @ 12.08 hrs, Volume= 7,474 cf
Outflow = 0.33 cfs @ 12.57 hrs, Volume= 7,474 cf, Atten= 85%, Lag= 29.0 min
Discarded = 0.12 cfs @ 12.57 hrs, Volume= 5,736 cf
Primary = 0.22 cfs @ 12.57 hrs, Volume= 1,738 cf

Routing by Sim-Route method, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Peak Elev= 221.08' @ 12.57 hrs Surf.Area= 2,048 sf Storage= 2,671 cf

Plug-Flow detention time= 92.7 min calculated for 7,471 cf (100% of inflow)
Center-of-Mass det. time= 92.6 min (848.2 - 755.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	219.00'	1,277 cf	**15.75'W x 130.00'L x 3.21'H Field A** 6,569 cf Overall - 2,313 cf Embedded = 4,256 cf x 30.0% Voids
#2A	219.50'	2,313 cf	**Cultec R-280HD** x 54 Inside #1 Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap Row Length Adjustment= +1.00' x 6.07 sf x 3 rows
#3	221.50'	2,815 cf	**4.00'D x 224.00'H Vertical Cone/Cylinder**
#4	224.00'	1,146 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
		7,551 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
224.00	0	0	0
225.00	2,292	1,146	1,146

Device	Routing	Invert	Outlet Devices
#1	Discarded	219.00'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 1.00' Phase-In= 0.01'
#2	Primary	220.10'	**3.0" Vert. Orifice/Grate** C= 0.600
#3	Primary	224.83'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 0.5' Crest Height

Discarded OutFlow Max=0.12 cfs @ 12.57 hrs HW=221.08' (Free Discharge)
└**1=Exfiltration** (Controls 0.12 cfs)

Primary OutFlow Max=0.22 cfs @ 12.57 hrs HW=221.08' TW=0.00' (Dynamic Tailwater)
├**2=Orifice/Grate** (Orifice Controls 0.22 cfs @ 4.45 fps)
└**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Subcatchment A-2: Uncaptured

Runoff = 0.11 cfs @ 12.12 hrs, Volume= 531 cf, Depth= 1.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=8.15"

Area (sf)	CN	Description
5,123	39	>75% Grass cover, Good, HSG A
533	30	Woods, Good, HSG A
5,656	38	Weighted Average
5,656		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Minimum Tc**

Summary for Subcatchment A-3: To Frontage Road

Runoff = 0.38 cfs @ 12.09 hrs, Volume= 1,206 cf, Depth= 5.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=8.15"

	Area (sf)	CN	Description
*	1,760	98	Paved parking
	750	39	>75% Grass cover, Good, HSG A
	2,510	80	Weighted Average
	750		29.88% Pervious Area
	1,760		70.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Minimum Tc**

Summary for Subcatchment A-4: Off-Locus Uncaptured

Runoff = 0.58 cfs @ 12.10 hrs, Volume= 1,907 cf, Depth= 2.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=8.15"

	Area (sf)	CN	Description
*	2,573	98	Paved parking
	2,663	39	>75% Grass cover, Good, HSG A
	3,346	30	Woods, Good, HSG A
	8,582	53	Weighted Average
	6,009		70.02% Pervious Area
	2,573		29.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment A-5: Single Unit Roofs

Runoff = 0.63 cfs @ 12.08 hrs, Volume= 2,266 cf, Depth= 7.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=8.15"

	Area (sf)	CN	Description
*	3,438	98	Roofs
	3,438		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Minimum Tc**

Summary for Subcatchment A-6: CB 2

Runoff = 0.30 cfs @ 12.08 hrs, Volume= 1,036 cf, Depth= 7.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=8.15"

	Area (sf)	CN	Description
*	1,569	98	Paved parking
	51	39	>75% Grass cover, Good, HSG A
	1,620	96	Weighted Average
	51		3.15% Pervious Area
	1,569		96.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Minimum Tc**

Summary for Subcatchment A-7: Multi-unit Roof

Runoff = 0.79 cfs @ 12.08 hrs, Volume= 2,848 cf, Depth= 7.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=8.15"

	Area (sf)	CN	Description
*	4,321	98	Roofs
	4,321		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Minimum Tc**

Summary for Subcatchment A-8: CB 1

Runoff = 1.07 cfs @ 12.08 hrs, Volume= 3,627 cf, Depth= 7.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=8.15"

	Area (sf)	CN	Description
*	5,438	98	Paved parking
	514	39	>75% Grass cover, Good, HSG A
	5,952	93	Weighted Average
	514		8.64% Pervious Area
	5,438		91.36% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Minimum Tc**

Summary for Reach 2R: Runoff

Inflow Area = 26,423 sf, 72.28% Impervious, Inflow Depth = 2.87" for 100-yr event
Inflow = 1.15 cfs @ 12.10 hrs, Volume= 6,315 cf
Outflow = 1.15 cfs @ 12.11 hrs, Volume= 6,315 cf, Atten= 0%, Lag= 0.6 min

Routing by Sim-Route method, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: Infiltration System 1

Inflow Area = 15,331 sf, 96.31% Impervious, Inflow Depth = 7.65" for 100-yr event
Inflow = 2.79 cfs @ 12.08 hrs, Volume= 9,777 cf
Outflow = 0.58 cfs @ 12.50 hrs, Volume= 9,777 cf, Atten= 79%, Lag= 25.0 min
Discarded = 0.12 cfs @ 12.50 hrs, Volume= 6,575 cf
Primary = 0.46 cfs @ 12.50 hrs, Volume= 3,201 cf

Routing by Sim-Route method, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Peak Elev= 224.00' @ 12.50 hrs Surf.Area= 2,063 sf Storage= 3,621 cf

Plug-Flow detention time= 99.0 min calculated for 9,773 cf (100% of inflow)
Center-of-Mass det. time= 99.0 min (850.0 - 751.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	219.00'	1,277 cf	**15.75'W x 130.00'L x 3.21'H Field A** 6,569 cf Overall - 2,313 cf Embedded = 4,256 cf x 30.0% Voids
#2A	219.50'	2,313 cf	**Cultec R-280HD** x 54 Inside #1 Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap Row Length Adjustment= +1.00' x 6.07 sf x 3 rows
#3	221.50'	2,815 cf	**4.00'D x 224.00'H Vertical Cone/Cylinder**
#4	224.00'	1,146 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
		7,551 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
224.00	0	0	0
225.00	2,292	1,146	1,146

Device	Routing	Invert	Outlet Devices
#1	Discarded	219.00'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 1.00' Phase-In= 0.01'
#2	Primary	220.10'	**3.0" Vert. Orifice/Grate** C= 0.600
#3	Primary	224.83'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 0.5' Crest Height

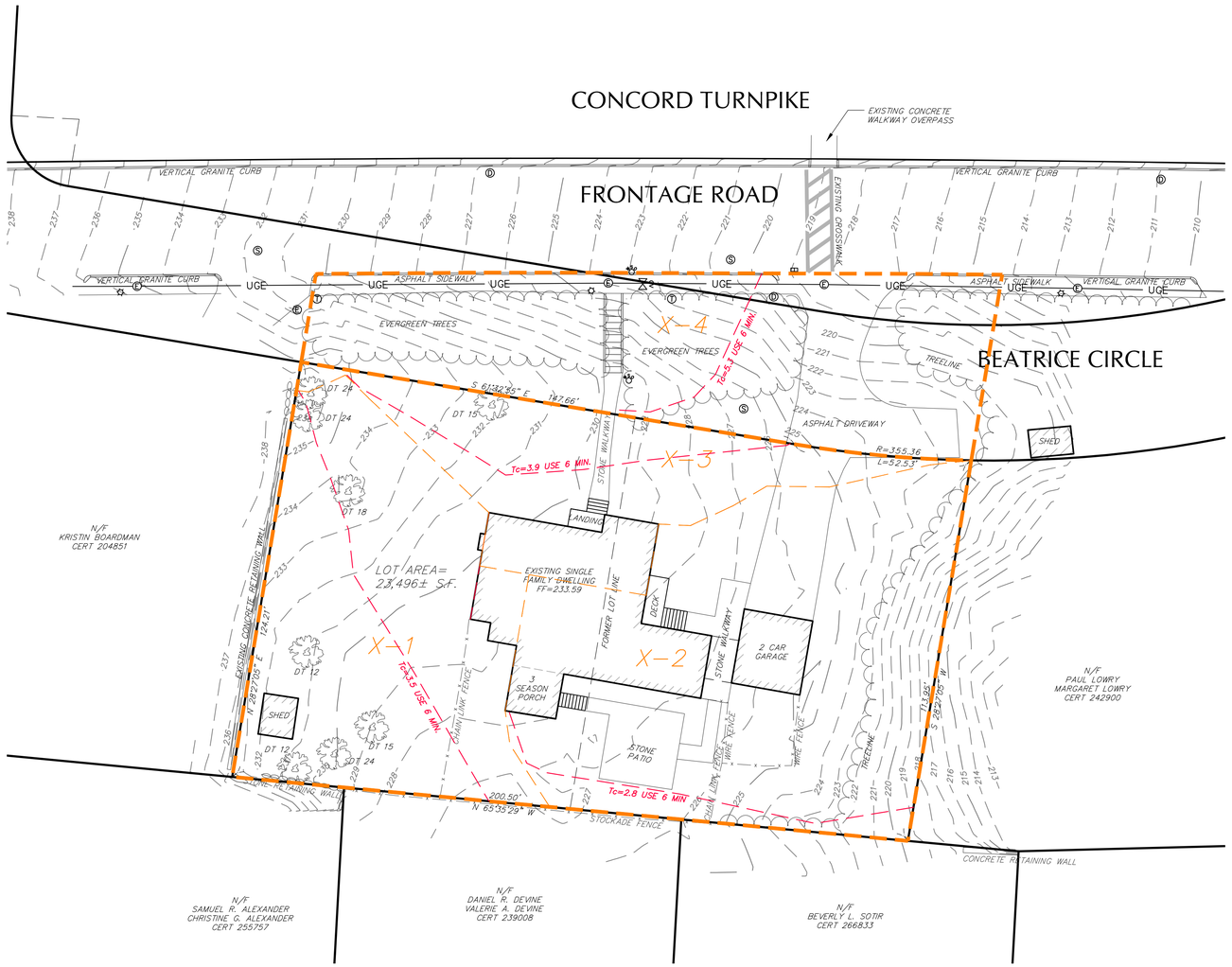
Discarded OutFlow Max=0.12 cfs @ 12.50 hrs HW=224.00' (Free Discharge)
└**1=Exfiltration** (Controls 0.12 cfs)

Primary OutFlow Max=0.46 cfs @ 12.50 hrs HW=224.00' TW=0.00' (Dynamic Tailwater)
├**2=Orifice/Grate** (Orifice Controls 0.46 cfs @ 9.36 fps)
└**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Watershed Maps

DESCRIPTION	X-1	X-2	X-3	X-4	TOTAL
PAVEMENT	0 S.F.	1,494 S.F.	370 S.F.	2,701 S.F.	4,565 S.F.
ROOF	414 S.F.	2,198 S.F.	941 S.F.	0 S.F.	3,553 S.F.
LAWN	7,367 S.F.	5,727 S.F.	3,323 S.F.	2,535 S.F.	18,952 S.F.
WOODS	0 S.F.	1,663 S.F.	0 S.F.	3,346 S.F.	5,009 S.F.
TOTAL	7,781 S.F.	11,082 S.F.	4,634 S.F.	8,582 S.F.	32,079 S.F.

APPROX MASS GRID



LEGEND:

EXISTING:

- LOCUS PROPERTY LINE
- TREE LINE
- SEWER MANHOLE (SMH)
- DRAIN MANHOLE (DMH)
- CATCH BASIN (CB)
- STONEWALL
- GAS VALVE
- WATER VALVE
- WATER SERVICE
- HYDRANT
- UTILITY POLE
- N/F – NOW OR FORMERLY
- D – DRAIN PIPE
- W – WATER MAIN
- G – GAS SERVICE
- UGE – UNDERGROUND POWER
- OHW – OVERHEAD WIRES
- S – SEWER MAIN
- LSA – LANDSCAPED AREA
- 25 – GRADE
- x25.7 – SPOT GRADE
- CHAIN LINK FENCE
- STOCKADE FENCE
- TEST PIT
- HAND HOLES FOR UTILITIES
- LIGHT POLE
- FF – FIRST FLOOR

DeCelle-Burke-Sala
& Associates, Inc.
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www.decelle-burke-sala.com

COMMONWEALTH OF MASSACHUSETTS
JAMES W. BURKE
No. 30418
REGISTERED PROFESSIONAL ENGINEER

JAMES W BURKE, P.E.

GENERAL NOTES:

1. LOCUS: ASSESSORS MAP 51 BLOCK LOT 36

   RECORD OWNER: COMPREHENSIVE LAND HOLDINGS
   DEED REFERENCE: CERTIFICATE #271959
   PLAN REFERENCE: LC PLAN 2367-12

2. ELEVATIONS REFER TO NAVD-88.

3. EXISTING UTILITIES WHERE SHOWN IN THE DRAWINGS ARE FROM SURFACE OBSERVATION AND RECORD INFORMATION AND SHOULD BE CONSIDERED APPROXIMATE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROPERLY LOCATING AND COORDINATING THE PROPOSED CONSTRUCTION ACTIVITY WITH DIG-SAFE AND THE APPLICABLE UTILITY COMPANIES AND MAINTAINING THE EXISTING UTILITY SYSTEM IN SERVICE.

   DIG-SAFE SHALL BE NOTIFIED PER THE STATE OF MASSACHUSETTS STATUTE CHAPTER 82, SECTION 409 AT TEL 1-888-344-7233. THE ENGINEER DOES NOT GUARANTEE THEIR ACCURACY OR THAT ALL UTILITIES AND SUBSURFACE STRUCTURES ARE SHOWN. LOCATIONS AND ELEVATIONS OF UNDERGROUND UTILITIES WERE TAKEN FROM RECORD PLANS. THE CONTRACTOR SHALL VERIFY SIZE, LOCATION, AND INVERTS OF UTILITIES AND STRUCTURES AS REQUIRED PRIOR TO THE START OF CONSTRUCTION.

4. THE LOT SHOWN DOES NOT LIE WITHIN A SPECIAL FLOOD HAZARD ZONE AS DELINEATED ON FIRM 25017C-0416E, DATED JUNE 4, 2010.

5. PARCEL IS ZONED SR-A.

PROJECT TITLE □ LOCATION:

SITE PLAN
91 BEATRICE CIRCLE
BELMONT, MASS.

PLAN TITLE:

EXISTING WATERSHED

PREPARED FOR:

91 BEATRICE CIRCLE LLC
c/o REGNANTE STERIO
401 EDGEWATER PL, SUITE 630
WAKEFIELD, MA 01880

DATE: NOVEMBER 4, 2020

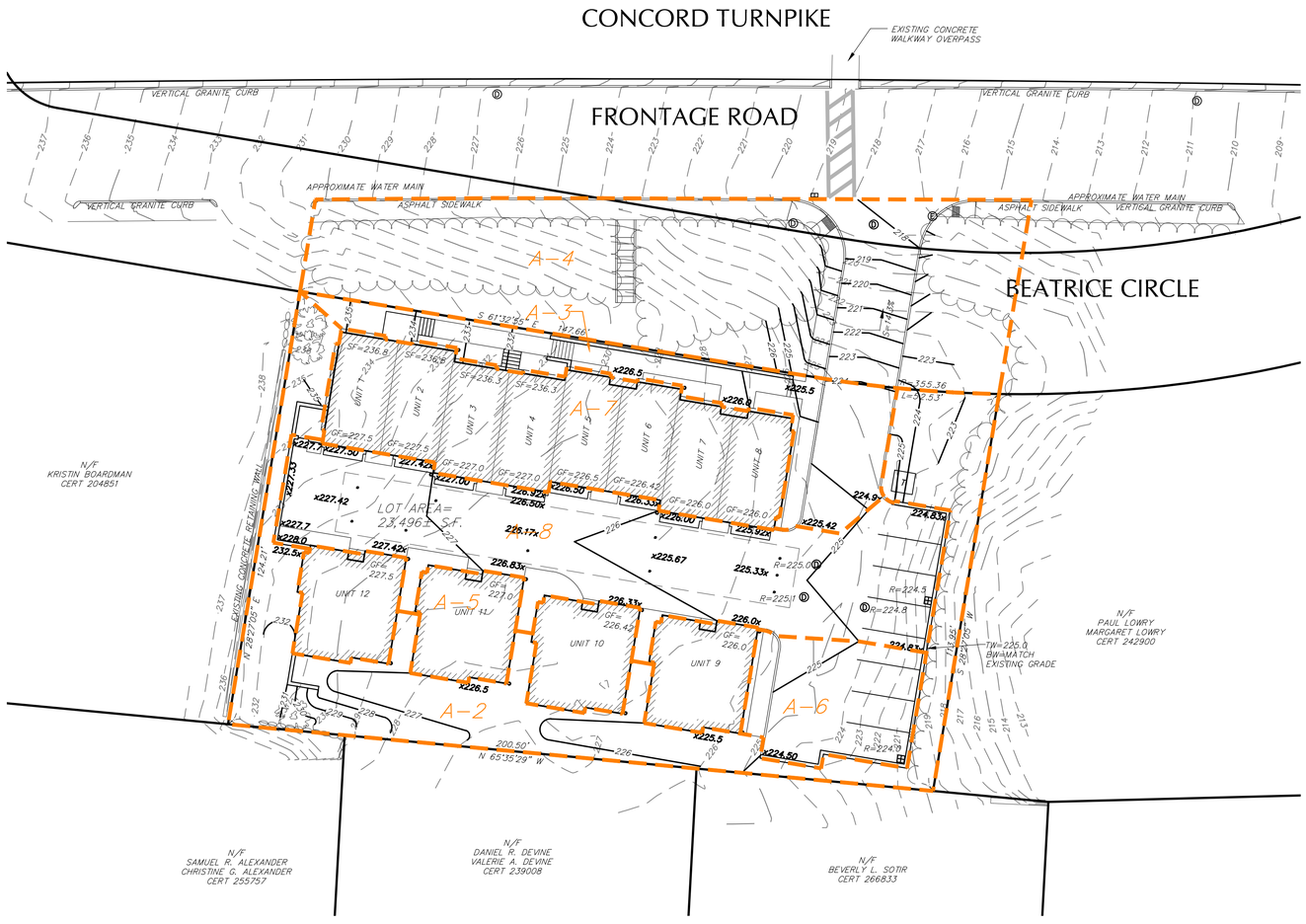
REVISED: APRIL 19, 2021

JOB NUMBER: 19.085 | SHEET 1 OF 2

20 10 0 20 40
SCALE: 1"=20'

DESCRIPTION	A–2	A–3	A–4	A–5	A–6	A–7	A–8	TOTAL
PAVEMENT	0 S.F.	1,760 S.F.	2,573 S.F.	0 S.F.	1,569 S.F.	0 S.F.	5,438 S.F.	11,340 S.F.
ROOF	0 S.F.	0 S.F.	0 S.F.	3,438 S.F.	0 S.F.	4,321 S.F.	0 S.F.	7,759 S.F.
LAWN	5,123 S.F.	750 S.F.	2,663 S.F.	0 S.F.	51 S.F.	0 S.F.	514 S.F.	9,101 S.F.
WOODS	533 S.F.	0 S.F.	3,346 S.F.	0 S.F.	0 S.F.	0 S.F.	0 S.F.	3,879 S.F.
TOTAL	5,656 S.F.	2,510 S.F.	8,582 S.F.	3,438 S.F.	1,620 S.F.	4,321 S.F.	5,952 S.F.	32,079 S.F.

APPROX. MASS GRID



LEGEND:

EXISTING:		PROPOSED:
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	– TREE LINE	
Ⓢ	– SEWER MANHOLE (SMH)	Ⓢ
Ⓓ	– DRAIN MANHOLE (DMH)	Ⓓ
	– CATCH BASIN (CB)	
	– STONEWALL	
GV	– GAS VALVE	GV
WV	– WATER VALVE	WV
	– WATER SERVICE	
	– HYDRANT	
	– UTILITY POLE	
N/F	– NOW OR FORMERLY	
D	– DRAIN PIPE	D
W	– WATER MAIN	W
G	– GAS SERVICE	G
UGE	– UNDERGROUND POWER	UGE
OHW	– OVERHEAD WIRES	OHW
S	– SEWER MAIN	S
LSA	– LANDSCAPED AREA	LSA
25	– GRADE	25
x25.7	– SPOT GRADE	x25.7
x x x x	– CHAIN LINK FENCE	
	– CHAIN LINK FENCE	
	– TEST PIT	
	– HAND HOLES FOR UTILITIES	
	– LIGHT POLE	
FF	– FIRST FLOOR	FF
TOF	– TOP OF FOUNDATION	TOF
GF	– GARAGE FLOOR	GF
	– EROSION CONTROL	

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COMMONWEALTH OF MASSACHUSETTS
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5. PARCEL IS ZONED SR–A.

PROJECT TITLE □ LOCATION:

SITE PLAN
91 BEATRICE CIRCLE
BELMONT, MASS.

PLAN TITLE:

PROPOSED WATERSHED

PREPARED FOR:

91 BEATRICE CIRCLE LLC
c/o REGNANTE STERIO
401 EDGEWATER PL, SUITE 630
WAKEFIELD, MA 01880

DATE: NOVEMBER 4, 2020
REVISED: APRIL 19, 2021

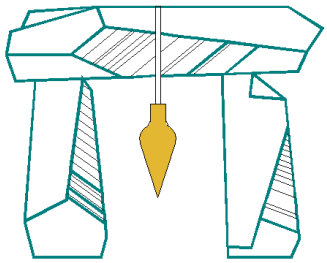
JOB NUMBER: 19.085 | SHEET 2 OF 2

20 10 0 20 40
SCALE: 1"=20'

SECTION 2 - REVISED MANAGEMENT PLANS

Stormwater Operation & Maintenance Plan
Erosion and Sedimentation Control Plan

DeCelle-Burke-Sala



& Associates, Inc.

Stormwater Operation & Site Maintenance Plan
for
91 Beatrice Circle
Belmont, Massachusetts

Prepared by:

DeCelle-Burke-Sala & Associates, Inc.
1266 Furnace Brook Parkway
Suite 401
Quincy, MA 02169

Prepared for:

91 Beatrice Circle LLC
c/o Regnante Sterio
401 Edgewater Pl., #603
Wakefield, MA 01880

Revised April 19, 2021

Introduction

This Stormwater Operation & Maintenance Plan (SOMP) is for the residential development and property located at 91 Beatrice Circle in Belmont, Massachusetts. The SOMP is outlined below to provide long term operation and maintenance procedures of the stormwater controls installed to manage the stormwater flow generated on the site. The landowners are required to implement the procedures and ensure the long term benefits of the stormwater controls approved and installed for this project. The SOMP provides simple operational and maintenance procedures for the stormwater control structures as well as perform various tasks to remove pollutants from areas that would have potential to be picked up on site and moved via stormwater offsite.

The landowners, also known as the condominium association, shall be responsible to inspect, maintain and operate the stormwater management system as well as inspect the grounds for eroded areas and collected pollutants. The stormwater recharge structure is located under the driveway between the buildings and can be observed through inspection ports.

Appointing a responsible person in charge to implement this SOMP on behalf of the landowner is preferred but the landowners shall be responsible at all times for implementing this SOMP. The purpose of the SOMP is to maintain the long term benefits from the Stormwater Management features constructed that support groundwater recharge and pollution prevention.

Responsible Party - 91 Beatrice Circle LLC
c/o Regnante Sterio
401 Edgewater Pl., #603
Wakefield, MA 01880

The responsible party listed above is responsible for inspecting, maintaining and keeping copies of maintenance records for the following plan and will be referred to as the Site Manager for the remainder of this report. If another individual/company is responsible for the every day management of the property the name and contact information shall be made available to the Town of Belmont. The responsible party can expect a yearly budget of $3,000 to $4,000 per year to maintain this site. This includes the necessary stormwater structure inspections, maintenance procedures, and snow management.

Upon any future transfer of ownership all future owners will be obligated to use, maintain, and continue to adhere to this SOMP in accordance with the manufacturers recommendations and all inspection records will be maintained and made available to the Town of Belmont upon request.

Non-Structural Operations

Pavement Sweeping

Pavement sweeping will be performed by hand twice during the year, in April-May and in September-October. The Site Manager shall contract with a property management company that provides pavement sweeping services. The company shall be in good standing in the Commonwealth of Massachusetts and experienced in performing these services. All sweepings shall be disposed of by the hired company off-site in a legal manner.

Snow Management

Proper snow management practices will be implemented to minimize runoff and pollutant loading impacts. Plowed or shoveled snow will be placed in pervious areas at the edges of the pavement where it can slowly infiltrate. Snow will be placed on to pervious areas that are not subject to excessive shade from buildings or vegetation. All accumulated sediment from snowmelt shall be removed each spring. If excessive snow inhibits movement around the properties or the stormwater management facilities The Site Manager will be responsible to remove the snow from the site and dispose of it in a legal manner. At no time shall snow be stored behind a retaining wall or on abutting properties.

Landscape Maintenance

The Site Manager shall hire a landscaper to provide proper lawn mowing practices and necessary shrub pruning to minimize sediment and pollutant loading impacts. The Landscaper will be responsible for all lawn clippings and landscape related debris to be collected and disposed of off-site in a legal manner. All landscape maintenance shall be conducted in a manner as to disallow all clippings, trimmings, and landscape product from being discharged into the drainage system or to be carried off site by stormwater runoff.

Structural Operations

Deep Sump Catch Basins, SNOUT® and Outlet Control Structure

The deep sump catch basins were installed to capture stormwater runoff and provide pretreatment for TSS and oils. The catch basins were fitted with a proprietary water quality outlet control assembly called a SNOUT® to assist in the efficiency of capturing TSS and oils. The SNOUT® has manufacturer suggested maintenance procedures attached to this document. The Site Manager shall review and follow these maintenance procedures to maximize the efficiency of the water quality catch basin hood. To ensure maximum capacity and efficiency, the deep sump catch basins and manhole sumps will be cleaned when half of the available capacity of the sump has been used or at a minimum of twice per year. The Manager shall inspect and clean the sumps of the catch basins at least twice per year or if a 24" depth of sediment exists in the sump. The Manager shall also inspect the drain manholes to ensure no blockage or sediment buildup is located within the structure. The Manager shall also inspect the outlet control structure to ensure the outlet is free and clear of any sediment or trash buildup. The Site Manager shall hire a contractor in good standing in the Commonwealth of Massachusetts with experience in cleaning stormwater sumps with a vacuum truck. All sediment and water retrieved from the sumps and other structures if required upon inspection. shall be disposed of by the hired company off-site in a legal manner. The Manager shall provide a written inspection report of which an example form is attached.

SNOUT®

The SNOUT® is a locally manufactured stormwater treatment product that is a vented fiberglass water quality hood that is installed over the outlet pipe in a storm water structure with a sump that skims oils, floatables and trash off of the surface water while letting settleable solids sink to the bottom. The cleaner water exits from beneath the SNOUT, which is lower than the bottom of the pipe, but above the bottom of the

structure allowing both floatable material and solids that sink to stay in the structure. Each catch basin and deep sump manhole structure is fitted with the SNOUT®. The Manager shall inspect the SNOUT® at least four times per year, the same time as the sumps are inspected. During inspection, the anti-siphon vent and access hatch are recommended to be inspected. A simple flushing of the vent, or a gentle rodding with a flexible wire are all that's typically needed to maintain the anti-siphon properties. The Site Manager shall hire a contractor in good standing in the Commonwealth of Massachusetts with experience in inspecting the SNOUT® and make sure it is operating as intended. If damaged the SNOUT® shall be repaired or replaced entirely. The Manager shall provide a written inspection report of each SNOUT® which an example form is attached. A copy of the SNOUT® Maintenance and Inspection Guide is attached to this document for additional information and manufacturer recommendations.

CDS 2015-4-C Water Quality Unit

The CDS 2015-4-C structure is a proprietary water quality treatment tank manufactured by Contech. The unit is installed for stormwater quality control and as pretreatment for the Cultec chamber recharge system. The Site Manager shall inspect the CDS unit more frequently once initially installed to determine the rate of sediment accumulation. To ensure maximum capacity and efficiency, the CDS Unit will be cleaned when half of the available capacity of the sump has been used or at a minimum of twice per year. We recommend the Site Manager clean the chambers a minimum of twice per year after becoming familiar with the unit or more often if necessary based on the initial inspections. The Site Manager shall hire a contractor in good standing in the Commonwealth of Massachusetts with experience in cleaning stormwater sumps with a vacuum truck. All sediment and water retrieved from the sumps and other structures if required upon inspection. shall be disposed of by the hired company off-site in a legal manner. The Manager shall provide a written inspection report of which an example form is attached. A copy of the Contech Maintenance and Inspection Guide for the CDS Unit is attached to this document for additional information and manufacturer recommendations.

Underground Cultec Chambers

The underground Cultec chambers were installed to improve water quality and recharge stormwater generated from the proposed parking lots, driveways and roofs. With two levels of treatment for the pavement runoff the infiltration chambers will remain effective with maintenance for a long period of time. The Site Manager shall inspect the chambers more frequently once initially installed to determine the rate of sediment accumulation. We recommend the Site Manager inspect the chambers a minimum of twice per year after becoming familiar with the system or more often if necessary based on the initial inspections. Inspection ports are brought to grade to allow The Site Manager to observe if the chambers are ponding or accumulating sediment. If sediment greater than 3-in. in depth is found, the row should be cleaned with high pressure water through a culvert cleaning nozzle. The use of CCTV inspection can be deployed through the inspection ports to determine if any sediment has accumulated. The Site Manager shall inspect the inlet and outlet pipes of the system to verify clogging and remove debris if necessary. If the chambers require service then The Site Manager shall hire a contractor in good standing in the Commonwealth of Massachusetts with experience in cleaning underground chambers with a vacuum truck. All sediment and water retrieved from the chambers shall be disposed of by the hired company off-site in a legal manner. The Site Manager shall provide a written inspection report of which an example form is attached. A copy of the Cultec Maintenance and Inspection Guide for the CDS Unit is attached to this document for additional information and manufacturer recommendations.

Site Management

The site shall be inspected on a quarterly basis for rutting, potholes, broken curbs, depressions, eroded areas and any other site damage caused by vehicular or human activity. Landscaped areas shall be raked as necessary to maintain their grade. Grassed areas shall be raked out and seeded as needed to maintain an even vegetated surface. The Site Manager shall hire a contractor in good standing in the Commonwealth of Massachusetts with experience in site management to repair any potholes, broken curbs, or other damaged exterior areas. The Site Manager shall hire a contractor in good standing in the Commonwealth of Massachusetts with experience in re-vegetating eroded areas and repairing vehicular surfaces and edges.

Record Keeping

Records of the inspections and maintenance for the Non-Structural and Structural Operations performed or organized by Manager for the property shall be up to date and available for review and inspection. Records shall be kept for a period of three years before being disposed of. An example record keeping sheet is attached.

Illicit Discharge Statement

Per Standard No. 10 of the MassDEP Stormwater Management Standards, there shall be no illicit discharges to the stormwater management system. The Property Manager is responsible for implementing the Operation and Maintenance Plan and overseeing activities at the facility to prevent illicit discharges to the drainage system from occurring. It is strictly prohibited to discharge any products or substances onto the ground surface or into any drainage structures, such as catch basin inlets, manholes, water quality units, forebays, basin or drainage outlets that would be a detriment to the environment.

Property Manager: _____ **Date** _____

Appendix

Manufacturer's Maintenance Considerations for Snout®

Manufacturer's CDS Guide for Maintenance

Cultec Chambers Operation & Maintenance Guide

Proposed Multi-Unit Residential Development

91 Beatrice Circle, Massachusetts

Stormwater Operation & Site Maintenance Plan

INSPECTION SCHEDULE AND EVALUATION CHECKLIST

Best Management Practice	Inspection Frequency	Date Inspected	Contractor	Current Conditions and Minimum Maintenance / Repairs, if necessary	Completed Maintenance / Repair (i.e. date, contractor, tasks complete, etc...)
Pavement Sweeping	Biannual				
Catch Basin w/Snout®	Biannual				
CDS Unit	Biannual				
Cultec Chambers	Biannual				
Parking Lot / Pavement / Walkways	Quarterly				
Retaining Walls	Biannual				
Vegetated Areas	Quarterly				
Overall Site Condition	Quarterly				

Property Manager: _____ **Date** _____

Maintenance Considerations for SNOUT® Stormwater Quality Systems

Background:

The SNOUT system from Best Management Products, Inc. (BMP, Inc.) is based on a vented hood that can reduce floatable trash and debris, free oils, and other solids from stormwater discharges. In its most basic application, a SNOUT hood is installed over the outlet pipe of a catch basin or other stormwater quality structure with a deep sump (see Installation Drawing). The SNOUT forms a baffle that traps floatable debris and free oils on the surface, while permitting heavier solids and sediment to sink to the bottom of the sump. The clarified intermediate layer is forced out of the structure through the open bottom of the SNOUT by displacement from incoming flow. The resultant discharge contains considerably less unsightly trash and other gross pollutants, and can also offer reductions of free-oils and finer solids. To increase pollutant removal capabilities of the SNOUT system, various accessories are available. The most popular options include: the Bio-Skirt® for higher hydrocarbon capture and retention, the Stainless TrashScreen™ for Full Trash Capture and the Turbo Plate® for turbulence reduction and higher sediment capture.

Maintenance Recommendations:

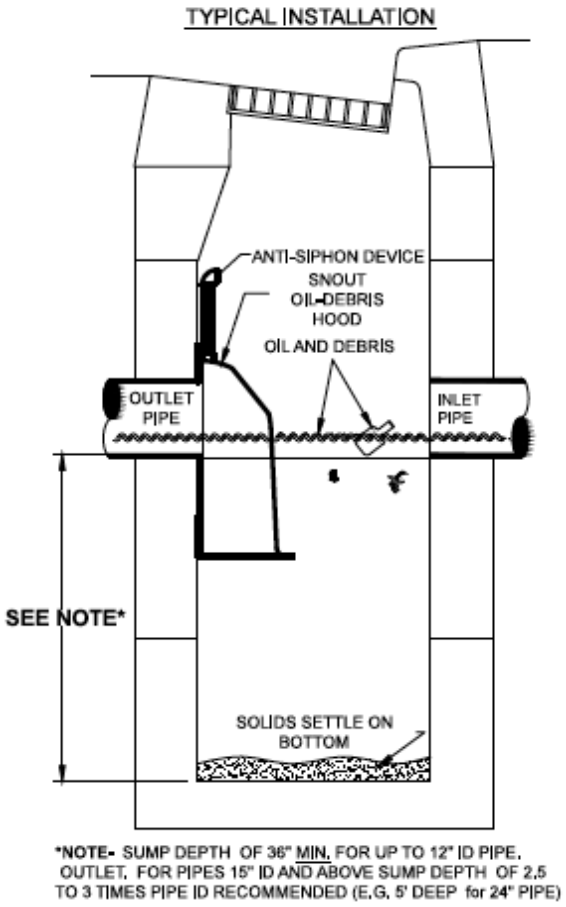
- Monthly monitoring for the first year of a new installation after the site has been stabilized is a recommended practice.
- Measurements should be taken after each rain event of .5 inches or more, or monthly, as determined by local weather conditions.
- Checking sediment depth and noting the surface pollutants in the structure will be helpful in planning maintenance.
- The pollutants collected in SNOUT equipped structures will consist of floatable debris and oils on the surface of the captured water, and grit and sediment on the bottom of the structure.
- It is best to schedule maintenance based on the solids collected in the sump.
- Optimally, the structure should be cleaned when the sump is half full (e.g. when 2 feet of material collects in a 4 foot sump, clean it out).
- Structures should also be cleaned if a spill or other incident causes a larger than normal accumulation of pollutants in a structure.
- Maintenance is best done with a vacuum truck.
- If Bio-Skirts are being used in the structure to enhance hydrocarbon capture, they should be checked on a monthly basis for the first year, and serviced or replaced when more than 2/3 of the boom is submerged, indicating a nearly saturated state. Assuming a typical pollutant-loading environment exists, Bio-Skirts should be serviced* annually or replaced as necessary.
- In the case of an oil spill, the structure should be checked and serviced and

Bio-Skirts (if present) replaced or serviced immediately.

- All collected wastes must be handled and disposed of according to local environmental requirements.
- To maintain the SNOUT hoods, an annual inspection of the anti-siphon vent and access hatch are recommended. A simple flushing of the vent, or a gentle rodding with a flexible wire are all that's typically needed to maintain the anti-siphon properties. Opening and closing the access hatch once a year ensures a lifetime of trouble-free service.

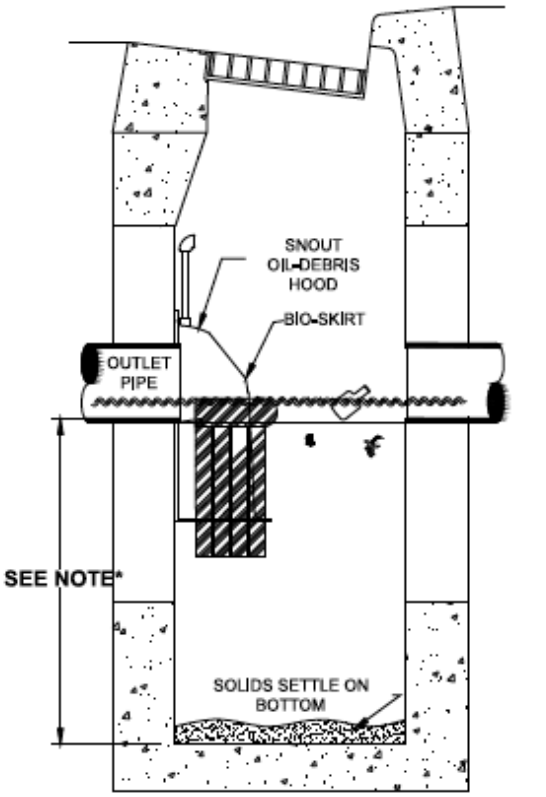
*To extend the service life of a Bio-Skirt, the unit may be "wrung out" to remove oils and washed in an industrial washing machine with warm water. The Bio-Skirt may then be re-deployed if the material maintains it's structural integrity. A maintained Bio-Skirt can last for several years. Each Bio-Skirt can hold about on gallon of oils.

SNOUT INSTALLATION:



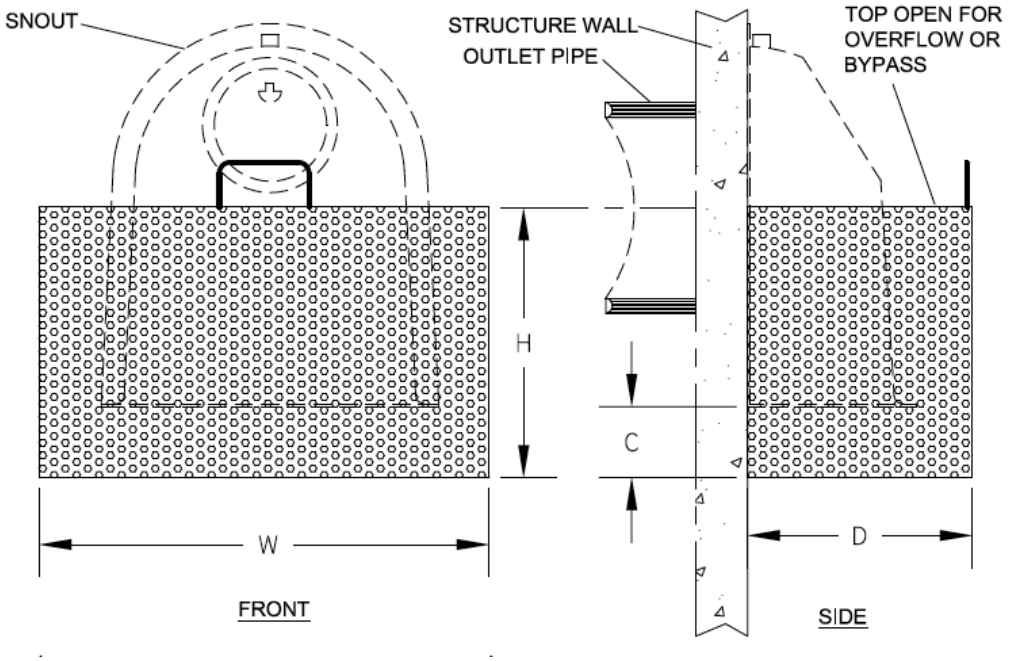
BIO-SKIRT INSTALLATION:

TYPICAL INSTALLATION



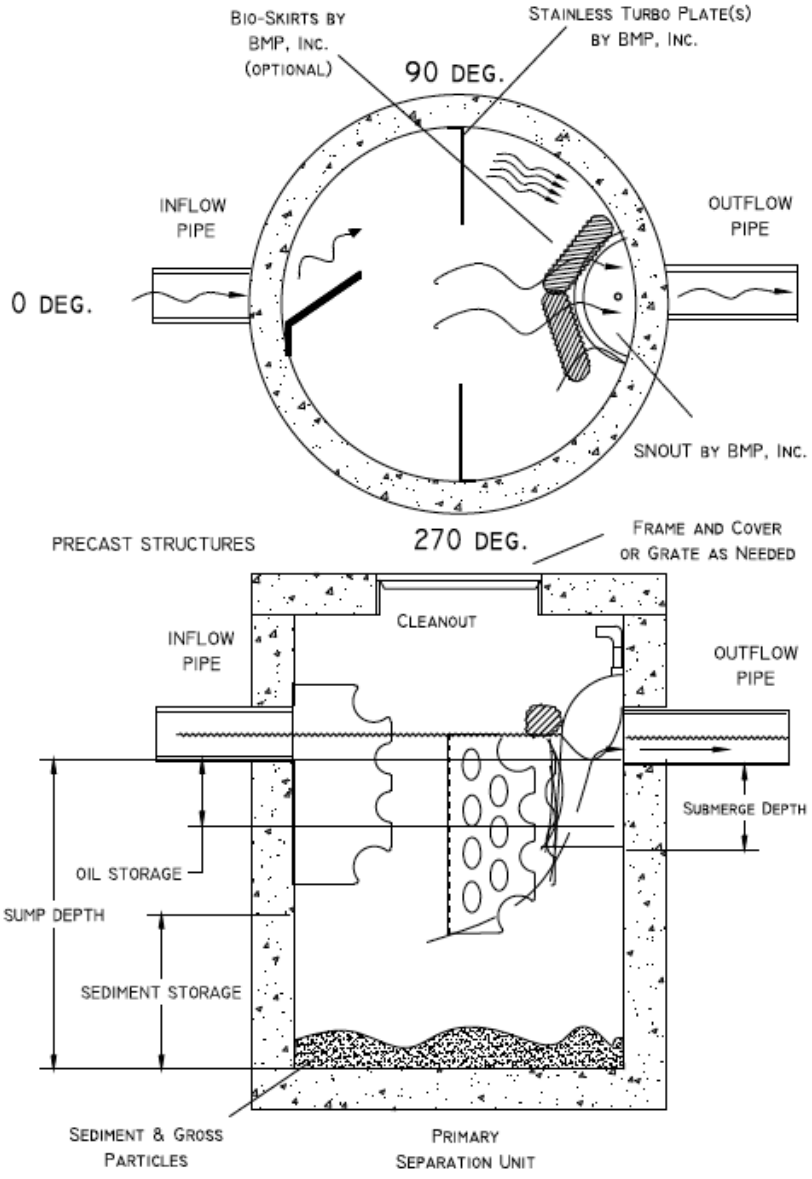
*NOTE- ATTACH BIO-SKIRT STRUTURE WALL SUCH THAT IT IS APPROXIMATELY AT SAME ELEVATION AS STATIC WATER LEVEL

STAINLESS TRASHSCREEN INSTALLATION:



TURBO PLATE INSTALLATION:

SNOUT TURBO PLATE-OIL-GRIT SEPARATOR



Contact Information: Please contact T. J. Mullen at 800-504-8008, tjm@bmpinc.com or Matt White at 888-434-0277, mwhite@bmpinc.com for design assistance.

Website: www.bmpinc.com

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CDS® Inspection and Maintenance Guide

CDS TECHNOLOGIES

Maintenance

The CDS system should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects pollutants will depend more heavily on site activities than the size of the unit. For example, unstable soils or heavy winter sanding will cause the grit chamber to fill more quickly but regular sweeping of paved surfaces will slow accumulation.

Inspection

Inspection is the key to effective maintenance and is easily performed. Pollutant transport and deposition may vary from year to year and regular inspections will help ensure that the system is cleaned out at the appropriate time. At a minimum, inspections should be performed twice per year (e.g. spring and fall) however more frequent inspections may be necessary in climates where winter sanding operations may lead to rapid accumulations, or in equipment washdown areas. Installations should also be inspected more frequently where excessive amounts of trash are expected.

The visual inspection should ascertain that the system components are in working order and that there are no blockages or obstructions in the inlet and separation screen. The inspection should also quantify the accumulation of hydrocarbons, trash, and sediment in the system. Measuring pollutant accumulation can be done with a calibrated dipstick, tape measure or other measuring instrument. If absorbent material is used for enhanced removal of hydrocarbons, the level of discoloration of the sorbent material should also be identified during inspection. It is useful and often required as part of an operating permit to keep a record of each inspection. A simple form for doing so is provided.

Access to the CDS unit is typically achieved through two manhole access covers. One opening allows for inspection and cleanout of the separation chamber (cylinder and screen) and isolated sump. The other allows for inspection and cleanout of sediment captured and retained outside the screen. For deep units, a single manhole access point would allows both sump cleanout and access outside the screen.

The CDS system should be cleaned when the level of sediment has reached 75% of capacity in the isolated sump or when an appreciable level of hydrocarbons and trash has accumulated. If absorbent material is used, it should be replaced when significant discoloration has occurred. Performance will not be impacted until 100% of the sump capacity is exceeded however it is recommended that the system be cleaned prior to that for easier removal of sediment. The level of sediment is easily determined by measuring from finished grade down to the top of the sediment pile. To avoid underestimating the level of sediment in the chamber, the measuring device must be lowered to the top of the sediment pile carefully. Particles at the top of the pile typically offer less resistance to the end of the rod than consolidated particles toward the bottom of the pile. Once this measurement is recorded, it should be compared to the as-built drawing for the unit to determine weather the height of the sediment pile off the bottom of the sump floor exceeds 75% of the total height of isolated sump.

Cleaning

Cleaning of a CDS systems should be done during dry weather conditions when no flow is entering the system. The use of a vacuum truck is generally the most effective and convenient method of removing pollutants from the system. Simply remove the manhole covers and insert the vacuum hose into the sump. The system should be completely drained down and the sump fully evacuated of sediment. The area outside the screen should also be cleaned out if pollutant build-up exists in this area.

In installations where the risk of petroleum spills is small, liquid contaminants may not accumulate as quickly as sediment. However, the system should be cleaned out immediately in the event of an oil or gasoline spill should be cleaned out immediately. Motor oil and other hydrocarbons that accumulate on a more routine basis should be removed when an appreciable layer has been captured. To remove these pollutants, it may be preferable to use absorbent pads since they are usually less expensive to dispose than the oil/water emulsion that may be created by vacuuming the oily layer. Trash and debris can be netted out to separate it from the other pollutants. The screen should be power washed to ensure it is free of trash and debris.

Manhole covers should be securely seated following cleaning activities to prevent leakage of runoff into the system from above and also to ensure that proper safety precautions have been followed. Confined space entry procedures need to be followed if physical access is required. Disposal of all material removed from the CDS system should be done in accordance with local regulations. In many jurisdictions, disposal of the sediments may be handled in the same manner as the disposal of sediments removed from catch basins or deep sump manholes.

CDS Model	Diameter		Distance from Water Surface to Top of Sediment Pile		Sediment Storage Capacity	
	ft	m	ft	m	y^3	m^3
CDS1515	3	0.9	3.0	0.9	0.5	0.4
CDS2015	4	1.2	3.0	0.9	0.9	0.7
CDS2015	5	1.3	3.0	0.9	1.3	1.0
CDS2020	5	1.3	3.5	1.1	1.3	1.0
CDS2025	5	1.3	4.0	1.2	1.3	1.0
CDS3020	6	1.8	4.0	1.2	2.1	1.6
CDS3025	6	1.8	4.0	1.2	2.1	1.6
CDS3030	6	1.8	4.6	1.4	2.1	1.6
CDS3035	6	1.8	5.0	1.5	2.1	1.6
CDS4030	8	2.4	4.6	1.4	5.6	4.3
CDS4040	8	2.4	5.7	1.7	5.6	4.3
CDS4045	8	2.4	6.2	1.9	5.6	4.3
CDS5640	10	3.0	6.3	1.9	8.7	6.7
CDS5653	10	3.0	7.7	2.3	8.7	6.7
CDS5668	10	3.0	9.3	2.8	8.7	6.7
CDS5678	10	3.0	10.3	3.1	8.7	6.7

Table 1: CDS Maintenance Indicators and Sediment Storage Capacities

Support

- Drawings and specifications are available at www.contechstormwater.com.
- Site-specific design support is available from our engineers.

Contech Engineered Solutions LLC provides site solutions for the civil engineering industry. Contech's portfolio includes bridges, drainage, sanitary sewer, stormwater, earth stabilization and wastewater treament products. For information, visit www.ContechES.com or call 800.338.1122

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800.925.5240
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CDS Inspection & Maintenance Log

CDS Model: _____ Location: _____

Date	Water depth to sediment[1]	Floatable Layer Thickness[2]	Describe Maintenance Performed	Maintenance Personnel	Comments

1. The water depth to sediment is determined by taking two measurements with a stadia rod: one measurement from the manhole opening to the top of the sediment pile and the other from the manhole opening to the water surface. If the difference between these measurements is less than the values listed in table 1 the system should be cleaned out. **Note: to avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the top of the sediment pile.**

2. For optimum performance, the system should be cleaned out when the floating hydrocarbon layer accumulates to an appreciable thickness. In the event of an oil spill, the system should be cleaned immediately.

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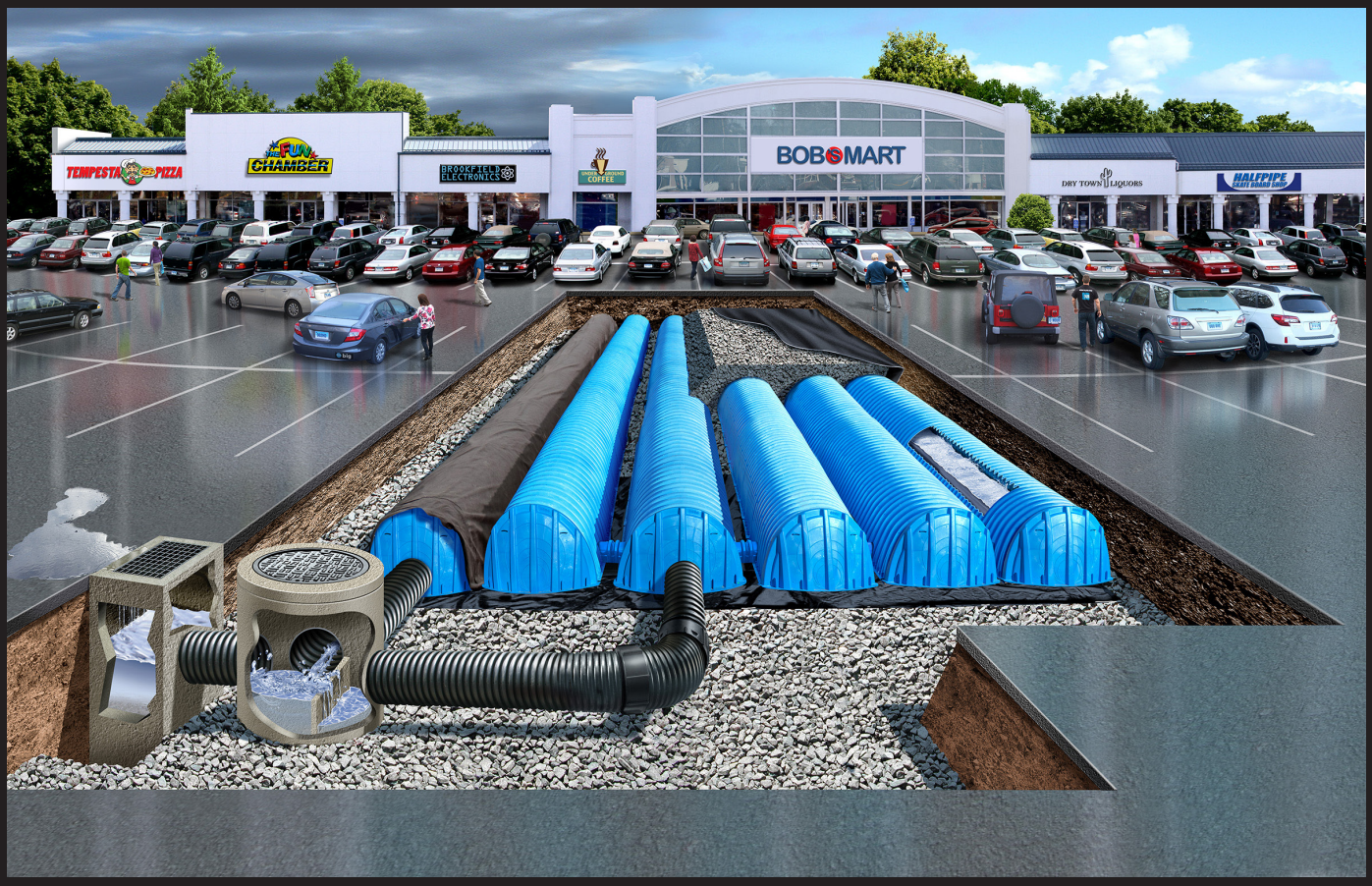
STORMWATER MANAGEMENT SOLUTIONS



OPERATION & MAINTENANCE GUIDELINES

FOR CULTEC STORMWATER MANAGEMENT SYSTEMS

CULTEC®

Published by
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Brookfield, Connecticut 06804 USA
www.cultec.com

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U.S. Patents 6,129,482; 6,322,288; 6,854,925; 7,226,241; 7,806,627; 8,366,346; 8,425,148; U.S. Designs D613,819; D638,095; D668,318; Canadian Patent 2,450,565; 2,591,255; Canadian Designs 129144; 135983; 159073; 160977; and/or other U.S. or Foreign Patent(s) or Patent(s) Pending.

Contact Information:
For general information on our other products and services, please contact our offices within the United States at (800)428-5832, (203)775-4416 ext. 202, or e-mail us at custservice@cultec.com.

For technical support, please call (203)775-4416 ext. 203 or e-mail tech@cultec.com.

Visit www.cultec.com/downloads.html for Product Downloads and CAD details.

Doc ID: CLT057 01-20
January 2020

These instructions are for single-layer traffic applications only. For multi-layer applications, contact CULTEC.
All illustrations and photos shown herein are examples of typical situations. Be sure to follow the engineer's drawings.
Actual designs may vary.

This manual contains guidelines recommended by CULTEC, Inc. and may be used in conjunction with, but not to supersede, local regulations or regulatory authorities. OSHA Guidelines must be followed when inspecting or cleaning any structure.

Introduction

The CULTEC Subsurface Stormwater Management System is a high-density polyethylene (HDPE) chamber system arranged in parallel rows surrounded by washed stone. The CULTEC chambers create arch-shaped voids within the washed stone to provide stormwater detention, retention, infiltration, and reclamation. Filter fabric is placed between the native soil and stone interface to prevent the intrusion of fines into the system. In order to minimize the amount of sediment which may enter the CULTEC system, a sediment collection device (stormwater pretreatment device) is recommended upstream from the CULTEC chamber system. Examples of pretreatment devices include, but are not limited to, an appropriately sized catch basin with sump, pretreatment catchment device, oil grit separator, or baffled distribution box. Manufactured pretreatment devices may also be used in accordance with CULTEC chambers. Installation, operation, and maintenance of these devices shall be in accordance with manufacturer's recommendations. Almost all of the sediment entering the stormwater management system will be collected within the pretreatment device.

Best Management Practices allow for the maintenance of the preliminary collection systems prior to feeding the CULTEC chambers. The pretreatment structures shall be inspected for any debris that will restrict inlet flow rates. Outfall structures, if any, such as outlet control must also be inspected for any obstructions that would restrict outlet flow rates. OSHA Guidelines must be followed when inspecting or cleaning any structure.

Operation and Maintenance Requirements

I. Operation

CULTEC stormwater management systems shall be operated to receive only stormwater run-off in accordance with applicable local regulations. CULTEC subsurface stormwater management chambers operate at peak performance when installed in series with pretreatment. Pretreatment of suspended solids is superior to treatment of solids once they have been introduced into the system. The use of pretreatment is adequate as long as the structure is maintained and the site remains stable with finished impervious surfaces such as parking lots, walkways, and pervious areas are properly maintained. If there is to be an unstable condition, such as improvements to buildings or parking areas, all proper silt control measures shall be implemented according to local regulations.

II. Inspection and Maintenance Options

A. The CULTEC system may be equipped with an inspection port located on the inlet row. The inspection port is a circular cast box placed in a rectangular concrete collar. When the lid is removed, a 6-inch (150 mm) pipe with a screw-in plug will be exposed. Remove the plug. This will provide access to the CULTEC Chamber row below. From the surface, through this access, the sediment may be measured at this location. A stadia rod may be used to measure the depth of sediment if any in this row. If the depth of sediment is in excess of 3 inches (76 mm), then this row should be cleaned with high pressure water through a culvert cleaning nozzle. This would be carried out through an upstream manhole or through the CULTEC StormFilter Unit (or other pretreatment device). CCTV inspection of this row can be deployed through this access port to deter mine if any sediment has accumulated in the inlet row.

B. If the CULTEC bed is not equipped with an inspection port, then access to the inlet row will be through an upstream manhole or the CULTEC StormFilter.

1. Manhole Access
This inspection should only be carried out by persons trained in confined space entry and sewer inspection services. After the manhole cover has been removed a gas detector must be lowered into the manhole to ensure that there are not high concentrations of toxic gases present. The inspector should be lowered into the manhole with the proper safety equipment as per OSHA requirements. The inspector may be able to observe sediment from this location. If this is not possible, the inspector will need to deploy a CCTV robot to permit viewing of the sediment.

2. StormFilter Access
Remove the manhole cover to allow access to the unit. Typically a 30-inch (750 mm) pipe is used as a riser from the StormFilter to the surface. As in the case with manhole access, this access point requires a technician trained in confined space entry with proper gas detection equipment. This individual must be equipped with the proper safety equipment for entry into the StormFilter. The technician will be lowered onto the StormFilter unit. The hatch on the unit must be removed. Inside the unit are two filters which may be removed according to StormFilter maintenance guidelines. Once these filters are removed the inspector can enter the StormFilter unit to launch the CCTV camera robot.

C. The inlet row of the CULTEC system is placed on a polyethylene liner to prevent scouring of the washed stone beneath this row. This also facilitates the flushing of this row with high pressure water through a culvert cleaning nozzle. The nozzle is deployed through a manhole or the StormFilter and extended to the end of the row. The water is turned on and the inlet row is back-flushed into the manhole or StormFilter. This water is to be removed from the manhole or StormFilter using a vacuum truck.

III. Maintenance Guidelines

The following guidelines shall be adhered to for the operation and maintenance of the CULTEC stormwater management system:

A. The owner shall keep a maintenance log which shall include details of any events which would have an effect on the system's operational capacity.

B. The operation and maintenance procedure shall be reviewed periodically and changed to meet site conditions.

C. Maintenance of the stormwater management system shall be performed by qualified workers and shall follow applicable occupational health and safety requirements.

D. Debris removed from the stormwater management system shall be disposed of in accordance with applicable laws and regulations.

IV. Suggested Maintenance Schedules

A. Minor Maintenance
The following suggested schedule shall be followed for routine maintenance during the regular operation of the stormwater system:

Frequency	Action
Monthly in first year	Check inlets and outlets for clogging and remove any debris, as required.
Spring and Fall	Check inlets and outlets for clogging and remove any debris, as required.
One year after commissioning and every third year following	Check inlets and outlets for clogging and remove any debris, as required.

B. Major Maintenance
The following suggested maintenance schedule shall be followed to maintain the performance of the CULTEC stormwater management chambers. Additional work may be necessary due to insufficient performance and other issues that might be found during the inspection of the stormwater management chambers. (See table on next page)

	Frequency	Action
Inlets and Outlets	Every 3 years	• Obtain documentation that the inlets, outlets and vents have been cleaned and will function as intended.
	Spring and Fall	• Check inlet and outlets for clogging and remove any debris as required.
CULTEC Stormwater Chambers	2 years after commissioning	• Inspect the interior of the stormwater management chambers through inspection port for deficiencies using CCTV or comparable technique. • Obtain documentation that the stormwater management chambers and feed connectors will function as anticipated.
	9 years after commissioning every 9 years following	• Clean stormwater management chambers and feed connectors of any debris. • Inspect the interior of the stormwater management structures for deficiencies using CCTV or comparable technique. • Obtain documentation that the stormwater management chambers and feed connectors have been cleaned and will function as intended.
	45 years after commissioning	• Clean stormwater management chambers and feed connectors of any debris. • Determine the remaining life expectancy of the stormwater management chambers and recommended schedule and actions to rehabilitate the stormwater management chambers as required. • Inspect the interior of the stormwater management chambers for deficiencies using CCTV or comparable technique. • Replace or restore the stormwater management chambers in accordance with the schedule determined at the 45-year inspection. • Attain the appropriate approvals as required. • Establish a new operation and maintenance schedule.
Surrounding Site	Monthly in 1st year	• Check for depressions in areas over and surrounding the stormwater management system.
	Spring and Fall	• Check for depressions in areas over and surrounding the stormwater management system.
	Yearly	• Confirm that no unauthorized modifications have been performed to the site.

For additional information concerning the maintenance of CULTEC Subsurface Stormwater Management Chambers, please contact CULTEC, Inc. at 1-800-428-5832.

WQMP
Operation & Maintenance (O&M) Plan

Project Name:_____

Prepared for:

Project Name: _____

Address:_____

City, State Zip:_____

Prepared on:

Date:_____

This O&M Plan describes the designated responsible party for implementation of this WQMP, including: operation and maintenance of all the structural BMP(s), conducting the training/educational program and duties, and any other necessary activities. The O&M Plan includes detailed inspection and maintenance requirements for all structural BMPs, including copies of any maintenance contract agreements, manufacturer's maintenance requirements, permits, etc.

8.1.1 Project Information

Project name	
Address	
City, State Zip	
Site size	
List of structural BMPs, number of each	
Other notes	

8.1.2 Responsible Party

The responsible party for implementation of this WQMP is:

Name of Person or HOA Property Manager	
Address	
City, State Zip	
Phone number	
24-Hour Emergency Contact number	
Email	

8.1.3 Record Keeping

Parties responsible for the O&M plan shall retain records for at least 5 years.

All training and educational activities and BMP operation and maintenance shall be documented to verify compliance with this O&M Plan. A sample Training Log and Inspection and Maintenance Log are included in this document.

8.1.4 Electronic Data Submittal

This document along with the Site Plan and Attachments shall be provided in PDF format. AutoCAD files and/or GIS coordinates of BMPs shall also be submitted to the City.

Appendix ____

BMP SITE PLAN

Site plan is preferred on minimum 11” by 17” colored sheets, as long as legible.

BMP OPERATION & MAINTENANCE LOG

Project Name: _____

Today's Date: _____

Name of Person Performing Activity (Printed): _____

Signature: _____

BMP Name (As Shown in O&M Plan)	Brief Description of Implementation, Maintenance, and Inspection Activity Performed

Minor Maintenance

Frequency		Action
Monthly in first year		Check inlets and outlets for clogging and remove any debris, as required.
		Notes
□ Month 1	Date:	
□ Month 2	Date:	
□ Month 3	Date:	
□ Month 4	Date	
□ Month 5	Date:	
□ Month 6	Date:	
□ Month 7	Date:	
□ Month 8	Date:	
□ Month 9	Date:	
□ Month 10	Date:	
□ Month 11	Date:	
□ Month 12	Date:	
Spring and Fall		Check inlets and outlets for clogging and remove any debris, as required.
		Notes
□ Spring	Date:	
□ Fall	Date:	
□ Spring	Date:	
□ Fall	Date:	
□ Spring	Date:	
□ Fall	Date:	
□ Spring	Date:	
□ Fall	Date:	
□ Spring	Date:	
□ Fall	Date:	
□ Spring	Date:	
□ Fall	Date:	
One year after commissioning and every third year following		Check inlets and outlets for clogging and remove any debris, as required.
		Notes
□ Year 1	Date:	
□ Year 4	Date:	
□ Year 7	Date:	
□ Year 10	Date:	
□ Year 13	Date:	
□ Year 16	Date:	
□ Year 19	Date:	
□ Year 22	Date:	

Major Maintenance

	Frequency		Action
Inlets and Outlets	**Every 3 years**		Obtain documentation that the inlets, outlets and vents have been cleaned and will function as intended.
			Notes
	□ Year 1	Date:	
	□ Year 4	Date:	
	□ Year 7	Date:	
	□ Year 10	Date:	
	□ Year 13	Date:	
	□ Year 16	Date:	
	□ Year 19	Date:	
	□ Year 22	Date:	
	Spring and Fall		Check inlet and outlets for clogging and remove any debris, as required.
			Notes
	□ Spring	Date:	
	□ Fall	Date:	
	□ Spring	Date:	
	□ Fall	Date:	
	□ Spring	Date:	
	□ Fall	Date:	
	□ Spring	Date:	
	□ Fall	Date:	
	□ Spring	Date:	
	□ Fall	Date:	
	□ Spring	Date:	
	□ Fall	Date:	
CULTEC Stormwater Chambers	**2 years after commissioning**		□ Inspect the interior of the stormwater management chambers through inspection port for deficiencies using CCTV or comparable technique. □ Obtain documentation that the stormwater management chambers and feed connectors will function as anticipated.
			Notes
	□ Year 2	Date:	

Major Maintenance

	Frequency		Action
CULTEC Stormwater Chambers	**9 years after commissioning every 9 years following**		□ Clean stormwater management chambers and feed connectors of any debris. □ Inspect the interior of the stormwater management structures for deficiencies using CCTV or comparable technique. □ Obtain documentation that the stormwater management chambers and feed connectors have been cleaned and will function as intended.
			Notes
	□ Year 9	Date:	
	□ Year 18	Date:	
	□ Year 27	Date:	
	□ Year 36	Date:	
	45 years after commissioning		□ Clean stormwater management chambers and feed connectors of any debris. □ Determine the remaining life expectancy of the stormwater management chambers and recommended schedule and actions to rehabilitate the stormwater management chambers as required. □ Inspect the interior of the stormwater management chambers for deficiencies using CCTV or comparable technique. □ Replace or restore the stormwater management chambers in accordance with the schedule determined at the 45-year inspection. □ Attain the appropriate approvals as required. □ Establish a new operation and maintenance schedule.
			Notes
	□ Year 45	Date:	

Major Maintenance

	Frequency		Action
Surrounding Site	**Monthly in 1st year**		□ Check for depressions in areas over and surrounding the stormwater management system.
			Notes
	□ Month 1	Date:	
	□ Month 2	Date:	
	□ Month 3	Date:	
	□ Month 4	Date:	
	□ Month 5	Date:	
	□ Month 6	Date:	
	□ Month 7	Date:	
	□ Month 8	Date:	
	□ Month 9	Date:	
	□ Month 10	Date:	
	□ Month 11	Date:	
	□ Month 12	Date:	
	Spring and Fall		□ Check for depressions in areas over and surrounding the stormwater management system.
			Notes
	□ Spring	Date:	
	□ Fall	Date:	
	□ Spring	Date:	
	□ Fall	Date:	
	□ Spring	Date:	
	□ Fall	Date:	
	□ Spring	Date:	
	□ Fall	Date:	
	□ Spring	Date:	
	□ Fall	Date:	
	□ Spring	Date:	
	□ Fall	Date:	
	Yearly		□ Confirm that no unauthorized modifications have been performed to the site.
			Notes
	□ Year 1	Date:	
	□ Year 2	Date:	
	□ Year 3	Date:	
	□ Year 4	Date:	
	□ Year 5	Date:	
	□ Year 6	Date:	
	□ Year 7	Date:	

CULTEC, Inc.
878 Federal Road • P.O. Box 280 • Brookfield, CT 06804 USA
P: (203) 775-4416 • Toll Free: 1(800) 4-CULTEC • www.cultec.com

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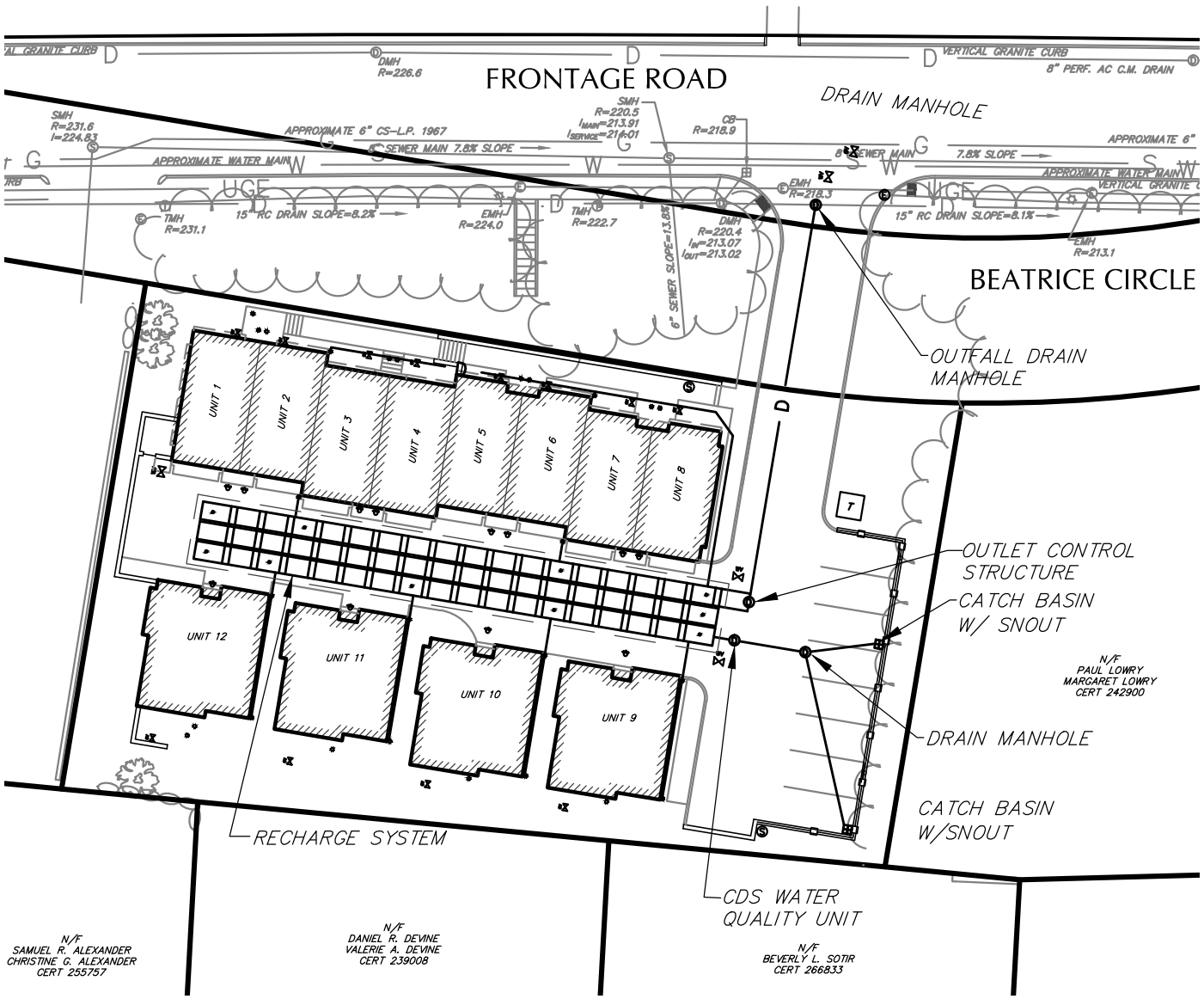


STORMWATER STRUCTURE LOCATION SKETCH

FOR

91 BEATRICE CIRCLE
BELMONT, MA

PREPARED FOR: 91 BEATRICE CIRCLE LLC
c/o REGNANTE STERIO
401 EDGEWATER PL, SUITE 630
WAKEFIELD, MA 01880

SCALE: 1"=40'

0 20 40

DeCelle-Burke-Sala & Associates, Inc.
1266 Furnace Brook Pkwy., #401
Quincy, MA 02169
(617) 405-5100 (O)
(617) 405-5101 (F)
www.decelle-burke-sala.com

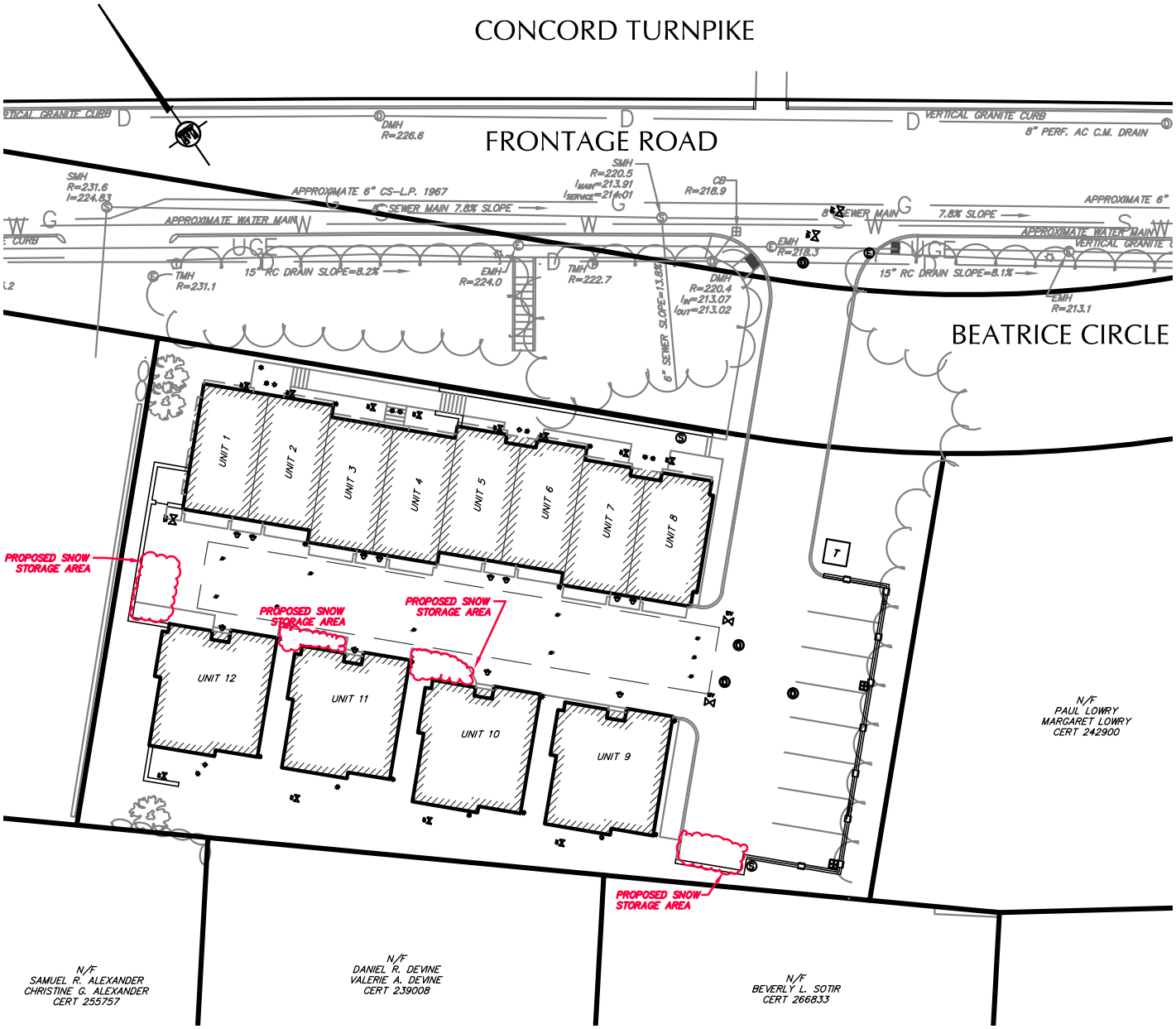
DATE: APRIL 19, 2021 JOB NUMBER: 2019.056

SNOW MANAGEMENT NOTES:

1. PROPERTY MANAGER SHALL HIRE A CONTRACTOR IN GOOD STANDING TO PLOW SNOW INTO AREAS SHOWN ON SKETCH. IF SNOW VOLUME EXCEEDS THE PROPERTY'S CAPABILITY TO SAFELY STORE THE SNOW ON-SITE THE CONTRACTOR SHALL REMOVE THE SNOW FROM THE SITE AND DISPOSE OF IT IN A LEGAL MANNER.

2. CONTRACTOR SHALL NOT STOCKPILE BEHIND THE RETAINING WALLS NOR OFF LOCUS OF THE PROPERTY.

3. CONTRACTOR TO REMOVE ACCUMULATED SEDIMENT AFTER SNOW MELT AND DISPOSE OF SEDIMENT IN A LEGAL MANNER.



SNOW STORAGE SKETCH

FOR

91 BEATRICE CIRCLE
BELMONT, MA

PREPARED FOR: 91 BEATRICE CIRCLE LLC
c/o REGNANTE STERIO
401 EDGEWATER PL, SUITE 630
WAKEFIELD, MA 01880

SCALE: 1"=40'

0 20 40

DeCelle-Burke-Sala & Associates, Inc.

1266 Furnace Brook Pkwy., #401
Quincy, MA 02169
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(617) 405-5101 (F)
www.decelle-burke-sala.com

DATE: APRIL 19, 2021 JOB NUMBER: 2019.056

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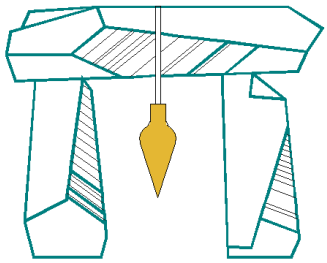

& Associates, Inc.

Erosion & Sedimentation Control Plan

for

91 Beatrice Circle

A Proposed Multi-Unit Residential Development in Belmont, Massachusetts

Prepared by:

DeCelle-Burke-Sala & Associates, Inc.
1266 Furnace Brook Parkway
Suite 401
Quincy, MA 02169

Prepared for:

91 Beatrice Circle LLC
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1.0 - Plan Objectives

- To protect abutting properties, public ways and drainage infrastructure from construction related pollutant impacts generated from land disturbance and construction activities;

- Control existing, and potential erosion, sediment transport and pollutant impact events by installing and maintaining construction related Best Management Practices (BMP's) to reduce and/or prevent the discharge of stormwater pollutants into wetland resources of the Commonwealth of Massachusetts;

- To protect surface stormwater quality, ground water quality, and minimize off-site sediment transport offsite during construction;

- To prevent local and off-site flooding by controlling peak rates and volumes of stormwater runoff during construction; and

- To eliminate illicit discharges to stormwater drainage systems that causes pollution during construction.

2.0 - Introduction

This Erosion and Sedimentation Control Plan (The "Plan") has been devised for the construction of a new multi-unit residential development located at 91 Beatrice Circle in Belmont, Massachusetts. The purpose of the Plan is to protect the surrounding environment from contaminated stormwater during construction of the development. The stormwater will be treated before release and surfaces stabilized to minimize erosive events by implementing, installing and maintaining construction related Best Management Practices (BMP's) to reduce and/or prevent the discharge of stormwater pollutants into wetland resources of the Commonwealth of Massachusetts. The BMP's are described in the Stormwater Management Standards developed by the Massachusetts Department for Environmental Protection and it is our belief that short term construction related pollution prevention generated from this site can be achieved.

3.0 - Current Site Conditions

The project site is one parcel of land totaling 23,496 square feet of land designated as Map 51 Lot 36 with the Town of Belmont Assessors. The site is currently improved with a one and one-half story single-family home with driveway access off Frontage Road and is zoned Single Residence A. The residential building is approximately a 2,730 square foot (s.f.) footprint with a 456 s.f. single story detached garage. The driveway extends from Frontage Road to the garage and provides for additional on-site parking.

The Subject Property is bounded by single-family homes to the east, west and south. Frontage Road, also known as Hinckley Way, is located to the north of the Subject Property. Frontage Road abuts Massachusetts' Route 2/Concord Turnpike. The Concord Turnpike is an eight-lane main thoroughfare providing service for commuter traffic for the City of Boston and the west and northwest communities of the Metro Boston region. Frontage Road is a one-way two lane road that travels east and provides access to the Concord Turnpike further east of the Subject Property. Frontage Road also delineates the municipal boundary between Arlington and Belmont and is part of the MBTA bus routes #62, 76, 78, and 84, providing service to the MBTA's Red Line in Cambridge, Massachusetts.

The Subject Property has mature landscaping around the home and along Frontage Road. The site has topography ranging in elevation from 236 on the west of the lot to elevation 218 on the east side of the lot. The majority of the lot surface topography rolls to the east and toward Frontage Road. Soils are mapped by the Natural Resources Conservation Service (NRCS) as a Charlton-Hollis Rock Complex consisting of shallow well-drained gravel and sand with ledge. Test pits were performed inconsistent with the Charlton Soil designation as no sand was found .

Public water and sewer with connections out to Frontage Road service the single-family home. Underground power and communications also service the home. There are no existing stormwater controls for the property. All existing stormwater flows over-ground to Frontage Road.

4.0 - Project Description

4.1 - Proposed Project

The proposed project includes constructing a new multi-unit affordable residential development subject to the Massachusetts Chapter 40B Housing regulations. The project consists of five new residential buildings, one four-story townhouse style building with eight units and the other four buildings each a two-story single-family home. Each of the twelve residential units contain three bedrooms. Each building will have a slab-on-grade style foundation.

Each residential unit has a single car garage with access off a shared driveway that is centered between the buildings. The driveway is accessed from Frontage Road in a similar location to the existing drive. The drive also provides access to an eight (8) space surface parking lot providing a total of twenty (20) spaces for a parking ratio of 1.67. A five-foot wide pedestrian walkway extends up the driveway from Frontage Road and connects to a walkway for the townhouse building and to the main driveway to the development.

The project includes razing the existing single-family home and garage, cutting and capping all service utilities and removing the paved driveway. The site grade will be lowered to the driveway elevation of 227 to 225. The slab-on-grade construction will minimize the disturbance to any pockets of subsurface ledge that may exist. Two retaining walls on either end of the site shall stabilize the site at a more level elevation for vehicular traffic and parking.

New utilities will be brought on-site in the vicinity of the driveway from Frontage Road. New water supply, fire protection, sewage disposal, power, communications and gas shall be brought on the site underground. A 6" water supply pipe shall extend from the water main and provide individual domestic services for each townhouse unit and fire protection for each building. A new 6" PVC sewer pipe shall extend from the sewer main and connect to the proposed southerly buildings providing a separate service for each unit. The northerly building shall use an existing sewer manhole that serviced the old home and extend to each unit connecting separate service. The existing sewer connection from this manhole to the sewer main shall remain in service.

Currently no stormwater controls exist on the site. The proposed stormwater control system consists of a surface collection system that includes two deep sump catch basins, one CDS 2015-4-C water quality unit manufactured by Contech and a single underground Cultec recharge system with 51 chambers and an overflow to the city system located at Frontage Road. The system provides local flood control, groundwater recharge capabilities and stormwater quality treatment. The system as proposed meets MassDEP Stormwater Management Standards and buffers flow off the property for the 2, 10, 25, and 100-year storm event.

5.0 - Erosion & Sedimentation Control Plan

The contractor shall implement an Erosion and Sedimentation Control Plan that protects the surrounding environment from sediment laden stormwater runoff generated during construction activities and from other pollutants generated from construction activities such as litter and dust. Construction sequencing is part of managing a site as is implementing many BMP's that assist in controlling construction related pollutants.

5.1 - Major Construction Sequence for Site

The sequence is developed to contain all potential sedimentation and erosion incidents that could occur during the construction of the project. The contractor however is responsible to manage the site effectively to control offsite sediment transport which may not be included in this plan. The sequence will coordinate the work within the erosion barrier and coordinate other sedimentation control features to reduce the stress upon a silt fence as well as limit off-site sediment transport. The sequencing is as follows:

- Place security fence around property to limit access and protect the public.
- Install silt sack in Frontage Road catch basin.
- Place stone apron at construction exit for site.
- Place erosion control barrier at limit of work where possible.
- Disconnect existing utility services and cut and cap the services at the main or source
- Raze existing buildings on-site.
- Remove pavement and dispose of material off-site
- Have a water truck on-site to minimize fugitive dust during the demolition process.
- Clear trees and grub site
- Remove stockpiled loam from site.
- Rough grade site. Remove excess material from the site
- Excavate for foundations. Remove excess soil material from excavation. If space becomes limited on-site, excess material shall be trucked off-site.
- Backfill and compact excavation as needed to construct foundation in accordance with the approved plans. Place excavated soils as backfill for foundation if possible to minimize stockpiled soils or have the unusable soils removed from the site.
- Begin vertical structural construction.
- Install catch basins, water quality unit and underground recharge structures for stormwater collection. Install silt sack once catch basins are installed.
- Tap existing sewer for sewer service and tap water service. Backfill excavation as soon as possible to minimize stockpiled soils.
- Install electrical and communication services. Backfill excavation as soon as possible to minimize stockpiled soils.

- Begin fine grade parking lot area and site.
- Place pavement binder for driveways.
- Place curbing around site.
- Pour concrete parking slab.
- Install final landscaping, including hydroseed, plantings, walkways and concrete pads.
- Final pave driveways.
- Clean up site.

The contractor has several procedures to perform to maintain the site. They include but are not limited to:

- Clean pavement of sediment as needed.
- Replace erosion control barrier at limit of work as needed. Barrier to be inspected on a weekly basis and after every storm event.
- Empty silt sacks after each rain event. Catch basins and manholes to be cleaned once sediment occupies 1/2 the sump available. Structures to be inspected on a weekly basis.
- Any stockpiled soils to be covered to minimize fugitive dust and surrounded by an erosion control barrier to prevent off-site sediment transport.
- Maintain a covered dumpster on site to minimize wind blown debris from littering neighborhood and resource areas.
- Have a water truck onsite during the demolition and excavation for the project and during rough grading to minimize fugitive dust. Water truck to be on-site during sweeping of pavement once installed.

5.2 - Best Management Practices

The contractor shall use various types of structural and non-structural methodologies to minimize offsite polluting from construction activities. The following is a list of some BMP's that can be utilized; however, it is the contractor's responsibility to implement his strategies to minimize offsite sediment transport and fugitive dust and trash.

5.2.1 - Perimeter Control / Limit of Work

The contractor shall install a six-foot high chan link temporary fence secured and set in the ground or set by the use of post anchors. The fence shall have a lockable gate at the site's construction entrance with visible contact information for the contractor secured to the gate. The fence shall have an erosion control sock installed and secured along the base of the fence base to assist in the capturing construction related sediment.

5.2.2 - Dumpster

The contractor shall have a dumpster on-site for the disposal of construction debris. The contractor shall cover the dumpster as needed to prevent wind blown debris from becoming litter in the environment.

5.2.3 - Silt Collection and Filter Bags

The contractor shall install filter sacks in all catch basins which may collect construction site stormwater runoff. The filter sacks will be inspected periodically for effectiveness and serviceability.

5.2.4 - Mechanical or Hand Sweeper

The contractor shall sweep the site by mechanical means or by hand to reduce the sediment build-up on-site. Prior to any site sweeping, water shall be applied to the surface. This will reduce the surrounding area becoming impacted from construction related offsite sediment pollution.

5.2.5 - Crushed Stone Construction Apron

A crushed stone apron shall be installed at the entrance to the site to assist in removing caked soil on construction vehicle tires. The apron shall be twenty five by twenty five foot wide. The contractor shall inspect the apron on a daily basis and supplement new stone as needed.

5.2.6 - Erosion Control Barrier

An erosion control barrier shall be installed at the downgradient limits of work and used around the site as needed. A barrier shall also be used around soil stockpiles and localized excavations on site. The barrier needs to be effective in controlling sediment transport and not becoming strained as the project moves forward. The contractor shall inspect the barrier weekly or after a large storm event to identify any stressed areas and replace the barrier as needed. The barrier can be one or many of several types, including but not limited to a staked and secure geotextile fabric, a geotextile erosion control sock, sand bags are typical types of barriers. The barriers shall be installed as to not concrete runoff and create erosion along its edge.

5.2.7 - Dust Control

The use of a water truck or other method to spray water over the site during the dry season to minimize blown dust shall be implemented. The water shall not be excessively spread so erosive forces occur. Prior to any site sweeping, water shall be applied to the surface to minimize fugitive dust to abutting properties. The contractor shall sweep the pavement once installed and cover stockpiled soils as needed to minimize dust. The contractor shall take special notice of using water

to minimize air born dust pollution specifically during the demolition, excavation, rough grading and pavement sweeping portions of the project operations.

5.2.8 - Disturbed Surface Maintenance

The contractor shall stabilize the ground surface as needed to prevent erosion. Stabilization of surfaces includes the placement of pavement, rip rap, wood bark mulch and the establishment of vegetated surfaces. Upon the completion of construction of a particular phase, all surfaces should be stabilized even though it is apparent that future construction efforts will cause their disturbance. Vegetated cover should be established during the proper growing season and should be enhanced by soil adjustment for proper pH, nutrients and moisture content. Surfaces that are disturbed by erosion processes or vandalism should be stabilized as soon as possible. Areas where construction activities have permanently or temporarily ceased should be stabilized within 14 days from the date of last construction activity, except when construction activity will resume within 21 days (e.g., the total time period that construction activity is temporarily ceased is less than 21 days). Hydro-mulching of grass surfaces is recommended, especially if seeding of the surfaces is required outside the normal growing season. Mulching may be used for temporary stabilization. Haybale dikes or silt fences should be set where required to trap products of erosion and should be maintained on a continuing basis during the construction process. Wheel ruts should be filled in and graded to prevent concentration of stormwater runoff. Vehicle tracks leading downhill should be blocked during periods of intense precipitation by haybales, dikes or silt fences which should be constructed to entrap the sediment.

5.2.9 - Temporary Stormwater Controls

The contractor shall rough grade the site as to not concentrate the stormwater runoff and cause erosive forces. The contractor shall use a level spreader, earth berm, earth swale or other temporary stormwater control device to control construction site runoff and prevent the runoff from creating and erosive soil situation. The catch basins and manholes can be installed to assist in capturing the construction site runoff once installed but the tanks will need to be cleaned out of all sediment before connecting the tanks to the recharge system and final paving. The use of silt sacks on the catch basin will help minimize the cleaning of the sumps. The contractor shall sweep the pavement once installed as needed to minimize suspended solids in the stormwater.

5.2.10 - Snow

The contractor shall manage on-site snow and not impact any abutting property or right-of-way in a negative way from construction snow management operations. The contractor can stockpile snow and allow it to melt in a controlled manner without impacts to the abutters. If the snow volume exceeds the stockpile

allowances available on-site the contractor shall remove it from the site and dispose of it in a legal manner.

5.2.11 - Material Management / Soil Stockpiles

The Contractor shall stockpile minimal amounts of soil for a short time frame. Soil stockpiles shall be located on-site and contained within the area as shown on the sketch. The stockpile will be covered to prevent dust pollution and ringed by erosion control barrier to prevent sediment transport. Soil proposed for removal from the site shall be excavated, stockpiled and placed in a truck for removal within 72 hours of collection. Other construction materials such as pipe, lumber, precast concrete, etc… shall be placed in an on-site manageable stockpile area and used in a timely manner to prevent overstocking the site and making it difficult to work. Construction related deliveries and pickups deliveries shall be timed to avoid early morning and late evening travel trips.

5.2.12 Site Construction Inspection Log

The contractor shall utilize a site construction inspection log to assist in the successful implementation of this Erosion & Sedimentation Control Plan. The log provides a checklist for ongoing inspections and the potential for reminding the contractor to use alternative methods of sedimentation control and erosion prevention. An example of a Site Construction Inspection Log is attached to this plan.

CONSTRUCTION SITE INSPECTION REPORT

1. Inspection Date:_____ 1a. Current weather conditions: _____ 1b. Rainfall with runoff since last inspection? ☐ Yes ☐ No

2. Name of Project: _____ 2a. Project No./Permit No._____

3. Project Location: _____

4. Inspection Type: ☐ Routine ☐ Pre-Rain ☐ During Rain ☐ After Rain ☐ Follow-up ☐ Other

5. Permit Type: ☐ Building Permit ☐ Grading Permit ☐ Site Development ☐ CIP Project

6. Project disturb 1 acre or more?:____(yes/no) NOI Required:_____(yes/no) SWPPP dated ____/_____/_____
Project covered under Statewide General Construction Activity Permit?_____(yes/no) SWPPP on site?_____(yes/no)

7. High Priority Site (significant threat to water quality)? _____(yes/no)
NOTE: Sites disturbing 1 acre or more AND High Priority Sites require monthly inspections during the wet season.

8. Project Type: ☐ Commercial/Industrial ☐ Residential ☐ Street Improvement ☐ Landscaping ☐ Utility (water,sewer, PG&E) ☐ Grading ☐ Demolition ☐ Other

9. Erosion Control Measures:

☐ Jute Netting / Fiber Blankets	☐ Adequate	☐ Requires Maintenance	☐ Non-Compliant	☐ Not Applicable
☐ Mulch	☐ Adequate	☐ Requires Maintenance	☐ Non-Compliant	☐ Not Applicable
☐ Hydroseed/Soil Binder/Compost Blanket	☐ Adequate	☐ Requires Maintenance	☐ Non-Compliant	☐ Not Applicable
☐ Mark Areas to be Preserved	☐ Adequate	☐ Requires Maintenance	☐ Non-Compliant	☐ Not Applicable
☐ Tree Protection Fencing	☐ Adequate	☐ Requires Maintenance	☐ Non-Compliant	☐ Not Applicable
☐ Riparian Area Barrier	☐ Adequate	☐ Requires Maintenance	☐ Non-Compliant	☐ Not Applicable

10. Sediment Control Measures

☐ Wattles / Fiber Rolls /Compost Socks	☐ Adequate	☐ Requires Maintenance	☐ Non-Compliant	☐ Not Applicable
☐ Silt Fences / Compost Berms	☐ Adequate	☐ Requires Maintenance	☐ Non-Compliant	☐ Not Applicable
☐ Sedimentation Basin	☐ Adequate	☐ Requires Maintenance	☐ Non-Compliant	☐ Not Applicable
☐ Intlet filters (Bags, sand, gravel)	☐ Adequate	☐ Requires Maintenance	☐ Non-Compliant	☐ Not Applicable
☐ Dust Control	☐ Adequate	☐ Requires Maintenance	☐ Non-Compliant	☐ Not Applicable
☐ Stabilized construction entrance	☐ Adequate	☐ Requires Maintenance	☐ Non-Compliant	☐ Not Applicable
☐ Check Dams	☐ Adequate	☐ Requires Maintenance	☐ Non-Compliant	☐ Not Applicable
☐ Street Sweeping	☐ Adequate	☐ Requires Maintenance	☐ Non-Compliant	☐ Not Applicable
☐ Earth Dikes / Drainage Swales	☐ Adequate	☐ Requires Maintenance	☐ Non-Compliant	☐ Not Applicable

11. Run-on and Runoff Control

☐ Earth Dikes / Drainage Swales	☐ Adequate	☐ Requires Maintenance	☐ Non-Compliant	☐ Not Applicable
☐ Sampling is conducted, if required	☐ Adequate	☐ Requires Maintenance	☐ Non-Compliant	☐ Not Applicable

12. ☐ Active Treatment System (if any) ☐ Adequate ☐ Requires Maintenance ☐ Non-Compliant ☐ Not Applicable
☐ Comments:_____

13. Good Site Management

☐ Construction Materials (wood,cement,etc)	☐ Adequate	☐ Requires Maintenance	☐ Non-Compliant	☐ Not Applicable
☐ Petroleum Products (oil, fuel)	☐ Adequate	☐ Requires Maintenance	☐ Non-Compliant	☐ Not Applicable
☐ Hazardous materials (paint,solvents)	☐ Adequate	☐ Requires Maintenance	☐ Non-Compliant	☐ Not Applicable
☐ Waste Systems Management	☐ Adequate	☐ Requires Maintenance	☐ Non-Compliant	☐ Not Applicable
☐ Soil Stockpiles	☐ Adequate	☐ Requires Maintenance	☐ Non-Compliant	☐ Not Applicable
☐ Vehicle Servicing	☐ Adequate	☐ Requires Maintenance	☐ Non-Compliant	☐ Not Applicable

14. Non-Stormwater Management

☐ Concrete washout area	☐ Adequate	☐ Requires Maintenance	☐ Non-Compliant	☐ Not Applicable
☐ Other: _____	☐ Adequate	☐ Requires Maintenance	☐ Non-Compliant	☐ Not Applicable

15. Are the discharge points free of any evidence of illicit discharge? ☐ Yes ☐ No Comments: _____
_____

16. **Enforcement/Follow-Up** Date problem first identified: _____ Next follow-up inspection date: _____
Comments:_____
_____
Enforcement: ☐ None/In Compliance ☐ Verbal Notice ☐ Notice to Comply ☐ Notice of Violation ☐ Stop Work ☐ Administrative Fine

17. Resolution: ☐ Problem Fixed ☐ Need More Time ☐ Escalate Enforcement ☐ Date resolved:_____
Was there rain with runoff after problem identified and before resolution? ☐ Yes ☐ No

18. Inspector's Signature:_____Date:_____

19. Name of Project Manager (Print) _____ Phone Number _____
Signature of Project Manager_____Date:_____